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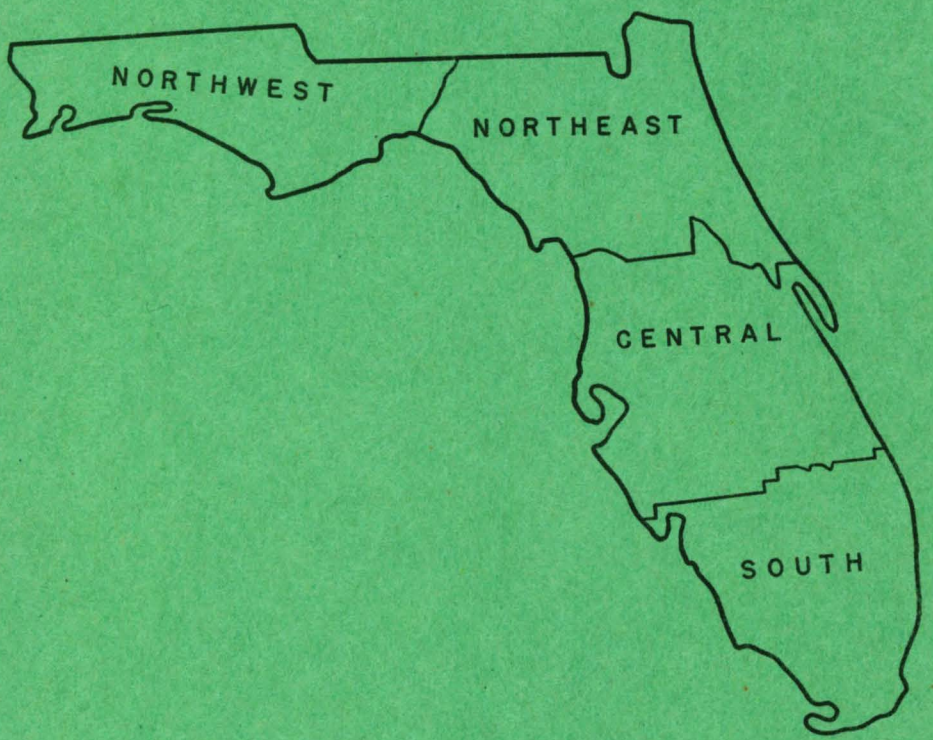
THE TIMBER SUPPLY SITUATION *in* Florida



FOREST SERVICE
United States Department of Agriculture
Forest Resource Report No. 6

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The Timber Supply Situation In Florida

ROBERT W. LARSON, *forest economist*

SOUTHEASTERN FOREST EXPERIMENT STATION
FOREST SERVICE

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Preface

THROUGH the McSweeney-McNary Act of 1928, Congress authorized the Secretary of Agriculture to conduct a comprehensive survey of the forest resources of the United States. The Forest Survey was organized by the Forest Service to carry out the provisions of the Act through the Regional Forest Experiment Stations. In the Southeastern States the Forest Survey is an activity of the Division of Forest Economics of the Southeastern Forest Experiment Station, Asheville, N. C.

The five-fold purpose of the Forest Survey is (1) to make a field inventory of the present supply of standing timber, (2) to ascertain the rate at which this supply is being increased through growth, (3) to determine the rate at which it is being reduced through industrial and domestic uses, fire and other causes, (4) to determine the present consumption and the probable future trend in requirements for forest products, and (5) to interpret and correlate these findings to aid in the formulation of private and public policies of forest land management.

Results of the Forest Survey are published in a series of reports that supply information needed for planning a long-time program for timber production and some localized information of use in guiding forest industry development. In this report no attempt is made to fully evaluate the use of forests for wildlife, recreation, or grazing; these uses are discussed only as they affect the timber supply.

Florida was inventoried by the Forest Survey in the period 1934-36 and reports presenting the findings have been published. Since then, cutting, forest growth, better fire protection, better forest management, changes in land use, and other factors have caused changes in the forest growing stock that can only be measured accurately by on-the-ground surveys. The information presented here is based upon a resurvey of the State, made between June 1948 and July 1949. It furnishes the background for an understanding of the present forest conditions in Florida and focuses attention upon the principal forest problems and what needs to be done to solve them.

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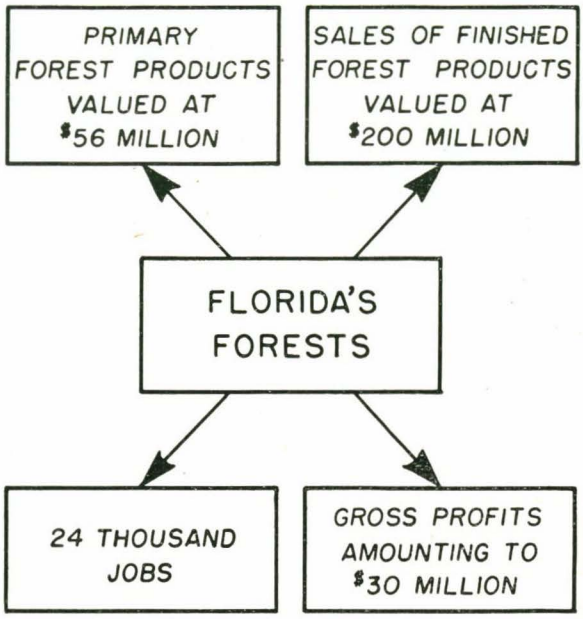
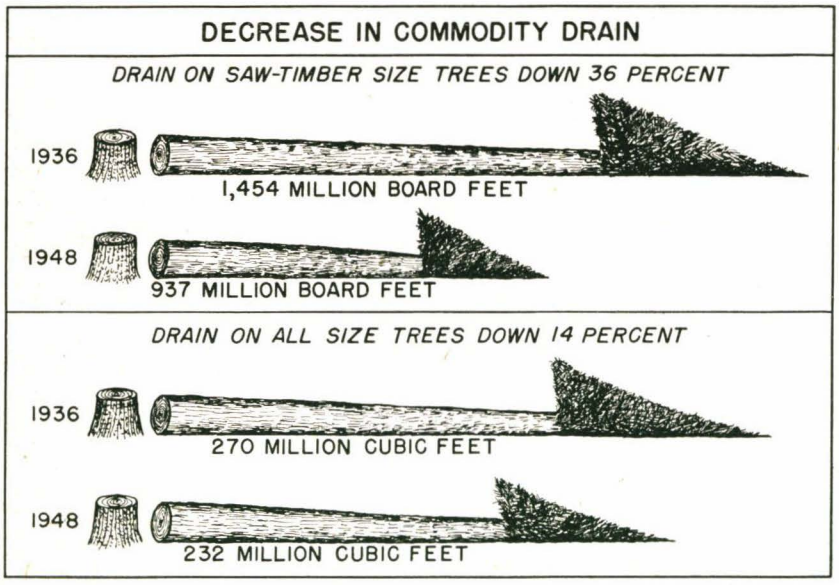
Summary of Survey Findings

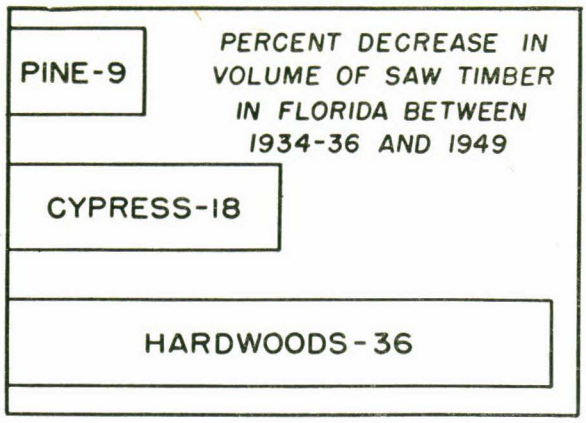
Florida's forests are among the State's top-ranking sources of income. In 1947, they provided the base for the leading group of manufacturing industries in the State, and were the most important source of industrial employment.


PRIMARY FOREST PRODUCTS VALUED AT $56 MILLION
SALES OF FINISHED FOREST PRODUCTS VALUED AT $200 MILLION
FLORIDA'S FORESTS
24 THOUSAND JOBS
GROSS PROFITS AMOUNTING TO $30 MILLION

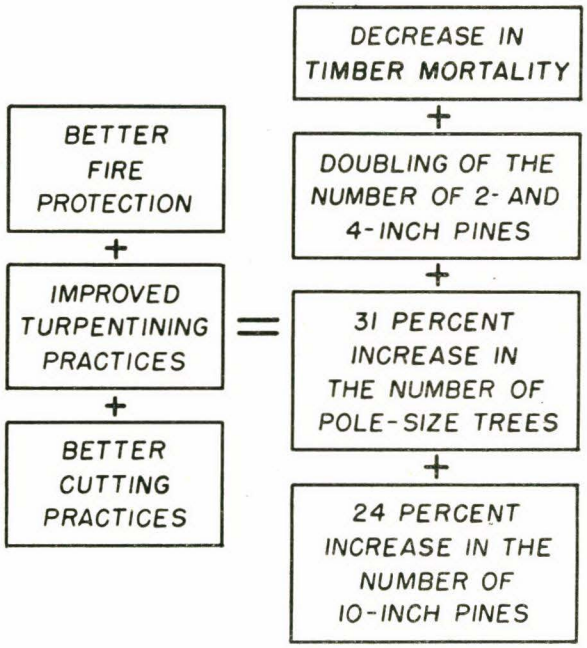
Since the time Florida's timber resources were first inventoried during the years 1934 to 1936, the timber supply and the dependent forest industries have undergone a number of significant changes. These are high lighted by a new survey, completed in 1949.



The decline in production of several forest products in Florida is especially noteworthy. Between 1936 and 1948, lumber production dropped a third. In 1948, the production of veneer logs and bolts, hewn ties, fence posts, and fuel wood was also below that of 1936. On the other hand, during this period, pulpwood production increased nearly sixfold, and that of poles and piling more than doubled. However, these increases failed to offset the decreases in other products; the net result was a decrease in commodity drain on both all timber 5.0 inches and larger and saw timber. Also, the production of gum naval stores declined during this period.

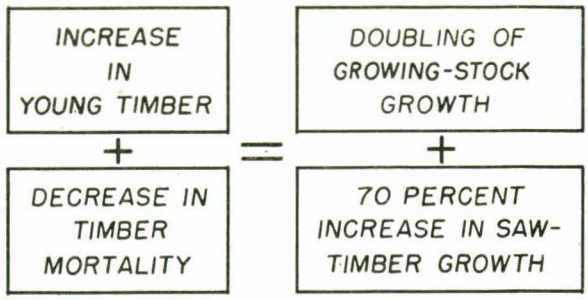


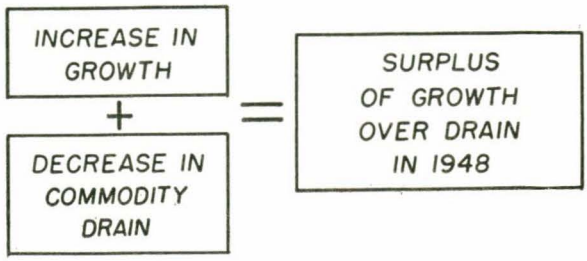
At least partially responsible for this decrease in the production of several forest products was the decline in timber volume which took place between surveys. These volume losses were confined almost entirely to the larger and better-quality timber. Practically all of the decrease in pine volume took place in the central and southern parts of the State, and, to a large extent, is attributable to clearing forest land for crops and pasture. The volume of pine, hardwood, and cypress pole timber increased, but not enough to offset the decline in saw timber. All in all, the 1949 survey revealed a 9-percent drop in the volume of all timber 5.0 inches and larger.

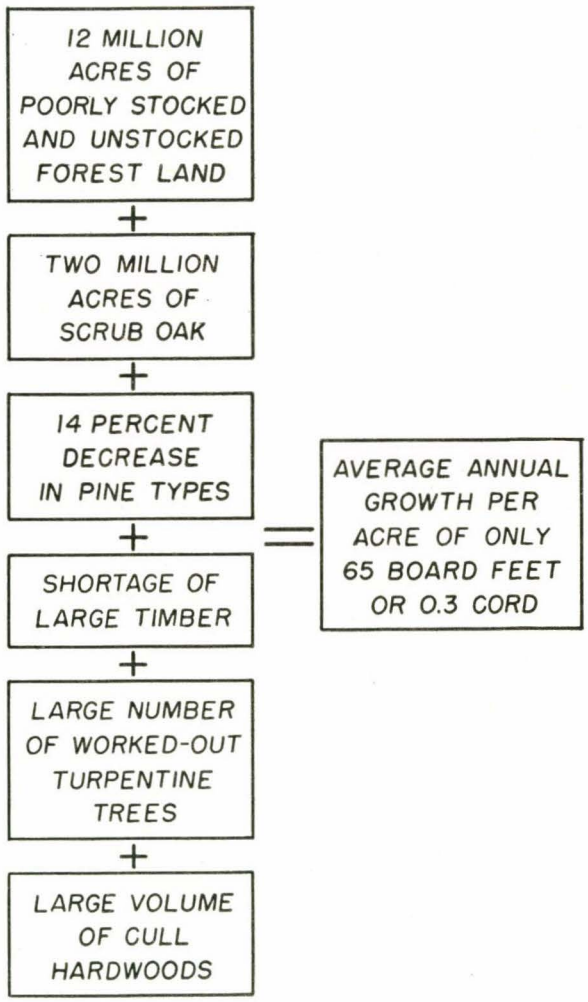


The amount of young timber increased, largely as a result of improved forest practices. However, a large part of this increase took place on a relatively small area, much of which was already well stocked. At the same time, losses due to timber mortality dropped. Better fire protection has permitted large areas to restock. The smaller number of trees worked for gum, the virtual elimination of the practice of working trees under 9.0 inches, and the utilization of small worked-out timber for pulpwood have reduced pine timber mortality to 14 percent of what it was in 1936.

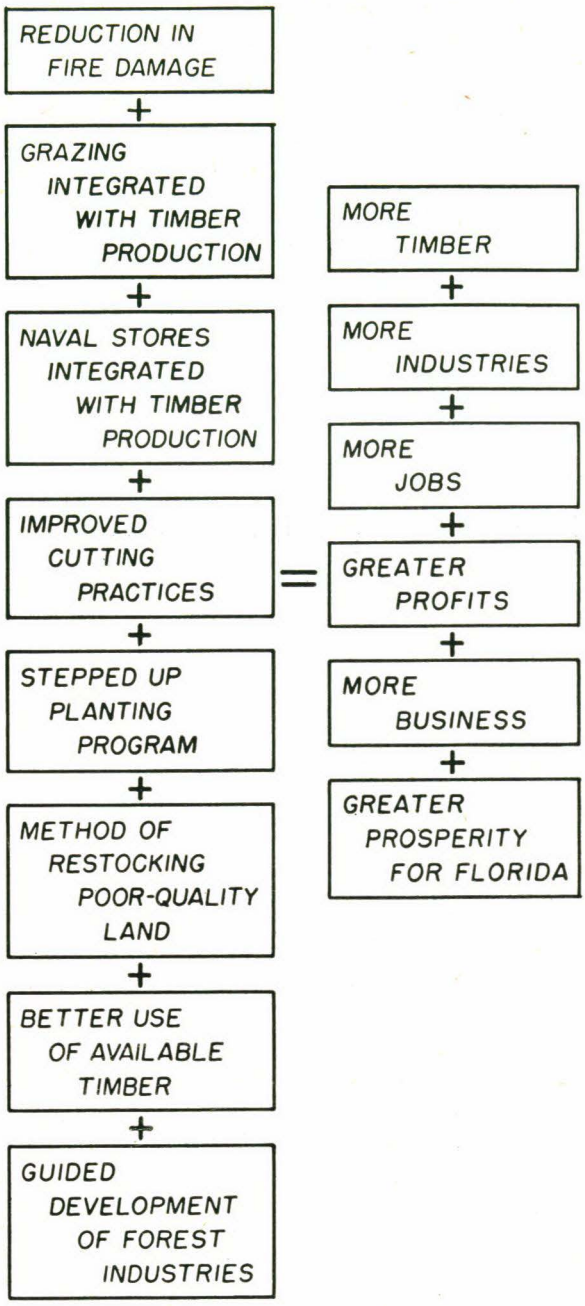
Although growth has increased, a large share of it is concentrated on trees under 12 inches; the larger size timber is still being cut faster than it is being replaced by growth. Also, a large part of this growth is on widely scattered trees in stands too thinly stocked to be logged profitably.






12 MILLION ACRES OF POORLY STOCKED AND UNSTOCKED FOREST LAND
+
TWO MILLION ACRES OF SCRUB OAK
+
14 PERCENT DECREASE IN PINE TYPES
+
SHORTAGE OF LARGE TIMBER
+
LARGE NUMBER OF WORKED-OUT TURPENTINE TREES
+
LARGE VOLUME OF CULL HARDWOODS
=
AVERAGE ANNUAL GROWTH PER ACRE OF ONLY 65 BOARD FEET OR 0.3 CORD

This increase in growth, coupled with the reduction in commodity drain, appears to have arrested, temporarily at least, the downward trend in timber volume. A surplus of growth over drain was achieved in 1948, but at a very low level of forest productivity.



Florida has 21.5 million acres of commercial forest land, but because of poor forest conditions, present growth on this area is only a fraction of the timber-growing capacity. Florida could easily grow 150 board feet per acre per year, or 0.6 cord.

Perhaps even more important than past changes and the present poor condition of the forest stands is this—many of the factors that produced the poor conditions are still active. In spite of the improvement in forest practices since the first survey, indiscriminate and careless burning of the woods, poor naval stores practices, and poor cutting practices are still prevalent enough in Florida to perpetuate many undesirable forest conditions. Continuation of these practices threatens to retard further progress. Corrective action along the lines suggested in the chart needs to be stepped up.

What Forests Mean to Florida

FLORIDA'S FORESTS are among the State's top-ranking sources of income. In value, primary forest products rank with the leading farm products and supply the main source of income to many small communities. In 1948, the gross cash income of Florida farmers from livestock and livestock products was 105 million dollars; from truck crops 89 million, and from citrus crops 72 million (7).[1] The value of primary forest products was 56 million dollars.

These forest products represent an array of commodities with sawlogs, pulpwood bolts, and gum for naval stores products heading the list in value (table 1). Other important commodities include veneer logs and bolts, pine stumps, fuel wood, piling, poles, hewn ties, and fence posts.

TABLE 1.—*Value of primary forest products, Florida, 1948*

Product	Value	
	Million dollars	*Percent*
Sawlogs	19	34
Pulpwood bolts	15	27
Gum for naval stores	7	13
Veneer logs and bolts	4	7
Pine stumps	3	5
Fuel wood	3	5
Other forest products	5	9
Total	56	100

Forests Support A 200-Million-Dollar Industry

Forests provide the base for the leading group of manufacturing industries in the State. The wholesale manufactured value of the principal forest products in 1948 amounted to 200 million dollars, and accounted for about a fifth of the sale value of all manufactured products.

[1] Italic numbers in parentheses refer to Literature Cited, p. 51.

Industries entirely or partially dependent upon forests for raw material are the most important source of industrial employment. In 1947, about 3 out of every 10 manufacturing workers were employed in forest industries. The 24 thousand jobs (*25*) they provide furnish the major means of livelihood to at least 85 thousand people.

In 1948, the wood-using industries outranked all others in number of firms, payrolls, income, and profit (*12*). Only in sales value and plant equipment value were the forest industries topped; in this they ranked second only to food and kindred products.

Of the 1,104 wood-using firms in 1948, 913 manufactured lumber and allied products. This group of industries headed the list of forest industries in plant and equipment value, number of employees, payrolls, profits, income, and sales. The pulp and paper industry, with only 31 firms, ranked a close second, and in wholesale manufactured value of products it exceeded the lumber industry.

Pulp and Paper Industry Growing

Between 1939 and 1947, the value added by the manufacture of forest products tripled. In spite of this gain, their relative importance among all industries did no change, since other industries made comparable gains. However, the make-up of the forest industries underwent significant changes. Chief among these was the growing importance of the pulp and paper industries and the decline of the lumber industries (fig. 1).

The rise of the pulp and paper industry has not only meant more jobs, but better-paid jobs. The average yearly earnings per employee in 1947 in the manufacture of paper and allied products was $2,726, compared to $2,146 for all industries and $1,642 for the lumber industry (table 2).

Although a complete shift to pulpwood production at the expense of lumber production would not be desirable or probable, the pulp and paper industry in Florida does provide a desirable stabilizing influence in the forest industries, which neither the old large "cut-out-and-get-out" band mills nor the present small sawmills have been able to give.

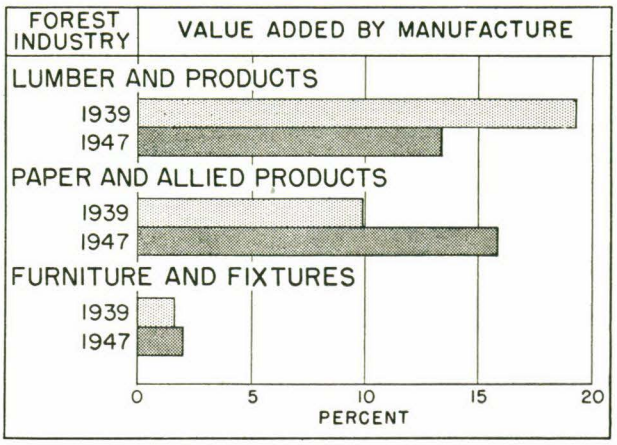


FIGURE 1.—*Percentage of the total value added by all manufacture, by major forest industry, Florida, 1939 and 1947. (Source: Bureau of the Census.)*

TABLE 2.—*Number of employees, salaries and wages, and average yearly earnings per employee for selected manufacturing industries, Florida, 1947* [1]

Industry	Employees		Salaries and wages	Average yearly earnings per employee
	Thousands	*Percent*	*Million dollars*	*Dollars*
Food and kindred products	19.6	25	43.0	2,197
Lumber and products	15.7	20	25.8	1,642
Tobacco manufactures	8.7	11	13.2	1,510
Paper and allied products	5.7	7	15.5	2,726
Furniture and fixtures	2.1	3	4.7	2,296
All other industries	26.9	34	66.6	2,476
All industries	78.7	100	168.8	2,146

[1] Data from Bureau of the Census.

Use of Timber in Florida

FLORIDA'S forest industries make heavy demands upon the timber resource. Some 684 sawmills, distributed from Pensacola to the Keys, cut more than one-half billion board feet of lumber annually, 8 large pulp mills consume at least a million cords of wood each year, veneer plants use nearly 100 million board feet of logs to make crates and boxes for citrus and truck crops, and wood naval stores plants in Florida and adjoining States annually harvest nearly three-fourths of a million tons of old-growth stumps. Nearly 14 million trees are chipped for their gum. Millions more are cut for hewn cross ties, poles, piles, fence posts, and fuel wood. All together, the production of these various forest products resulted, in 1948, in the cutting of 937 million board feet of saw timber and 2.7 million cords of wood from trees 5.0 inches d.b.h.[2] and larger, including saw timber.

[2] For definition of terms used in this report, see appendix p. 54.

Sawlogs and pulpwood are the principal products (fig. 2). These, together with veneer bolts and hewn cross ties, accounted for 94 percent of the total volume of wood cut in 1948 from sound trees. Of the timber cut 81 percent was pine, 8 percent was cypress, and 11 percent various species of hardwoods.

The amount of wood cut from Florida's forests has decreased since 1936, largely as a result of the decline in the lumber industry. In spite of tremendous wartime demands for lumber, the total cubic volume of timber cut in 1944 was 2 percent less than in 1936. By 1948 the volume cut had dropped to 14 percent below 1936. This is in sharp contrast to some of the other Southern States. In South Carolina, for example, commodity drain in 1942 was 42 percent above 1936 and still was 25 percent above the 1936 level in 1946.

Timber Used for Lumber

In spite of the decline in the lumber industry, timber cut for sawlogs is still the biggest item of

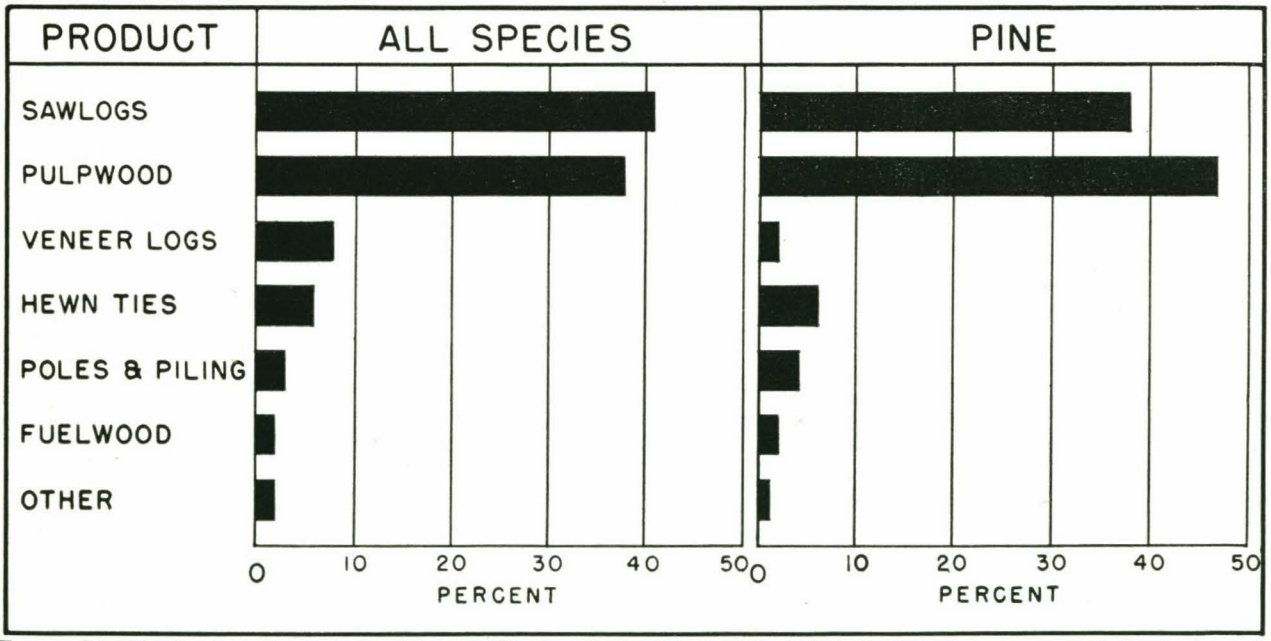


FIGURE 2.—*Distribution of commodity drain in Florida, by forest product, 1948. (Percentages based on cubic-foot volume.)*

commodity drain upon Florida's forests. Sawlog drain for the production of lumber amounted to 515 million board feet in 1948, or 55 percent of the commodity drain upon sound live saw timber.

In 1948, 684 sawmills in Florida (fig. 3) produced 571 million board feet of lumber, including sawn cross ties. Practically all of this lumber was cut from sawlogs harvested within the State, but about 34 million feet of logs were imported from Alabama and Georgia. Some lumber was also cut from the top portion of the bole that was not considered as of sawlog quality by the survey.

A rather high proportion of the lumber was cut by medium-size and large mills (fig. 4); more than a third of all the lumber produced in 1948 was sawn by 17 mills cutting 5 million board feet or more. Forty mills cutting 3 million or more produced more than one-half (table 3). This is in contrast to many of the other Southern States. In South Carolina, for instance, mills cutting 3 million feet or more in 1946 accounted for only 27 percent of the total cut.

A large number of the small sawmills (annual production less than 5 million feet) together produce very little lumber; 400 small mills cut only 6.2 per-

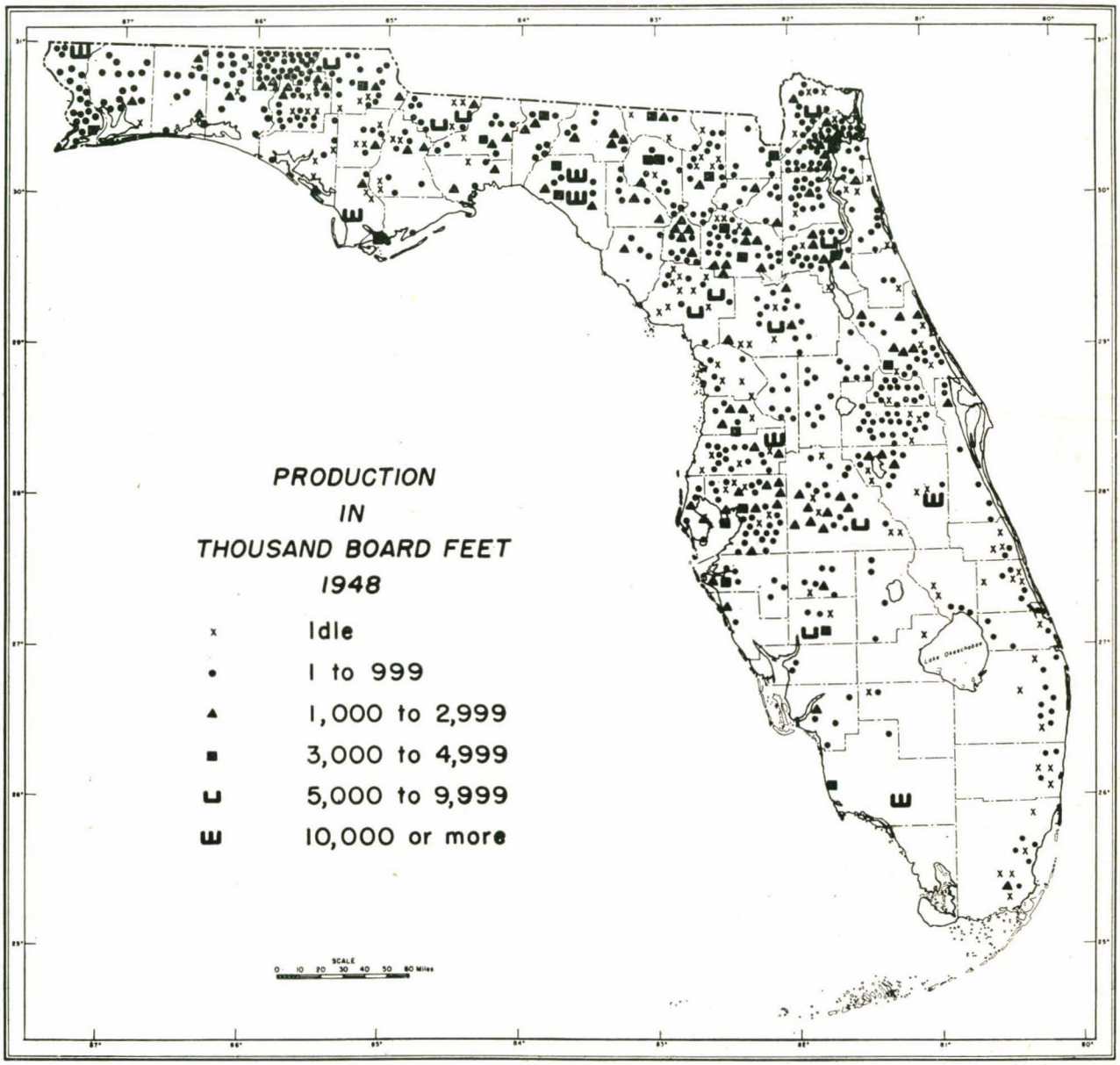


FIGURE 3.—*Location and size of Florida sawmills, 1948.*

TABLE 3.—*Lumber production by mill-size class, Florida, 1948*

Mill-size class (M bd. ft. per year)	Active mills	Pine	Cypress	Cedar	Hardwoods	Total	
	Number	*Thousand bd.ft.*	*Thousand bd.ft.*	*Thousand bd.ft.*	*Thousand bd.ft.*	*Thousand bd.ft.*	*Percent*
1–299	404	29,710	3,620	84	2,069	35,483	6.2
300–499	68	21,266	1,919	520	1,582	25,287	4.4
500–999	68	40,677	3,221	45	1,706	45,649	8.0
1,000–2,999	104	152,858	14,297	186	5,348	172,689	30.3
3,000–4,999	23	66,441	11,574	----------	5,095	83,110	14.6
5,000 and over	17	137,376	54,781	15	16,356	208,528	36.5
Total	684	448,328	89,412	850	32,156	570,746	100.0

cent of the total. The trend, however, is toward more of these smaller mills (table 4). As the old-growth timber is cut out, the remaining small and scattered timber is more suitable for small portable-mill operation. The result is that the small mills, which as a group sawed 30 percent of the lumber in 1909, accounted for 55 percent in 1942 and 63 percent in 1948.

The number of larger mills has not changed much in the past few years, but the mortality rate of big mills was particularly high during the early forties. Between 1942 and 1948, four plants which had an-

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FIGURE 4.—*Medium-size and large sawmills cut a relatively high proportion of Florida's lumber in 1948. More than a third was produced by 17 mills.*

TABLE 4.—*Number of Florida sawmills by size for selected years*

Annual production (M bd. ft.)	1909	1942	1948
	Number	*Number*	*Number*
Under 5,000	396	391	667
5,000–10,000	40	9	10
Over 10,000	35	11	7
Total	471	411	684

nually produced 10 million feet and more closed down. These were among the last survivors of the group of large band mills built for the purpose of cutting out a particular body of old-growth timber. In 1909, there were 35 such mills; in 1948, there were 7.

The increased number of small sawmills has not been able to offset the loss of production resulting from the shutting down of several of the larger mills. Lumber production rose rapidly around the turn of the century, and reached a peak of 1.2 billion board feet in 1909. Production held around a billion board feet a year until 1929; since then the general trend has been downward. In 1930, with a large part of the old-growth timber cut out and a major depression well under way, lumber production dropped abruptly and in 1932 reached a low of only 420 million board feet. A gradual recovery was made until, in 1936, 860 million board feet was produced (fig. 5). This has remained the high point in spite of the intense demands of World War II and the postwar construction boom, which in neighboring Georgia and Alabama sent production soaring to almost double the prewar level. During the war years the trend in Florida was steadily downward. Some recovery was evident by 1946, but both the 1947 and 1948 cuts were again lower.

The bulk of the lumber cut in Florida has always been pine. Pine lumber production has varied from more than 90 percent of the total cut during the first decade of the 20th century to less than 70 percent in 1931 and during the late thirties. For the most part, however, the proportion has remained close to 80 percent. In 1948, it was 78 percent.

Florida is the Nation's leading producer of cypress lumber. In 1947, Florida cut 28 percent of the total cut in the country, compared to 16 percent by the second ranking State, Louisiana. Prior to 1912, cypress lumber production accounted for about 8 percent of the total lumber cut in the State. In general, the proportion has varied between 10 and 20

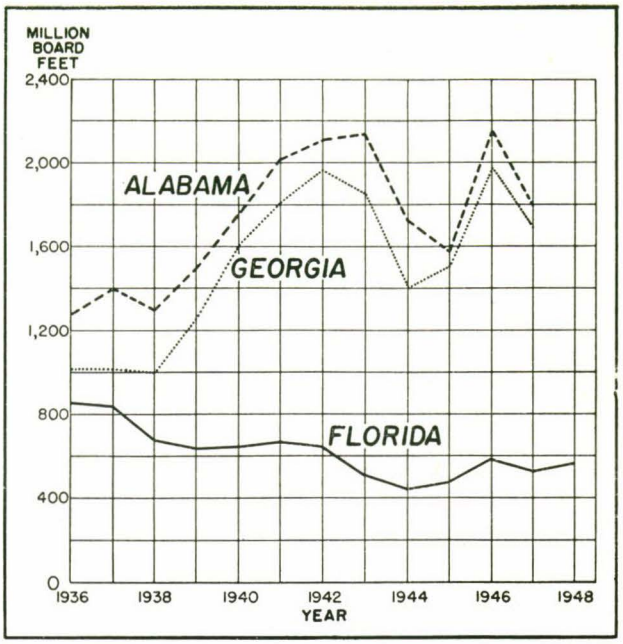

FIGURE 5.—*Total lumber production in Alabama, Florida, and Georgia, 1936-48.*

percent since that date, although it did top 20 percent during the middle twenties and again during the late thirties. In 1948, lumber sawn from cypress accounted for 16 percent of the total.

Hardwood lumber has always made up a very small part of the total lumber cut. Up until 1928, lumber cut from hardwood timber accounted for only 1 or 2 percent of the total. Since then the proportion has varied between 5 and 10 percent; in 1948 it was 6 percent.

In 1948, Taylor County ranked as the number-one producer of lumber, accounting for 13 percent of the total production in the State. Escambia County was second with 5 percent, followed by Duval, Polk, Marion, Alachua, and Hillsborough, each with slightly more than 4 percent. These seven counties produced two-fifths of all the lumber sawn in Florida.

Timber Used for Pulpwood

The first Florida pulp mill went into production in 1931, followed by three more in 1938 and increasing to a total of eight mills distributed across northern Florida in 1948 (fig. 6). Since 1936 the amount of timber cut for pulpwood has increased nearly sixfold and in 1948 nearly equalled the amount of timber cut for sawlogs (fig. 7). Annual pulpwood production more than doubled in the period 1939 through 1948, and in 1948 totaled 1,221,000 cords (fig. 8).

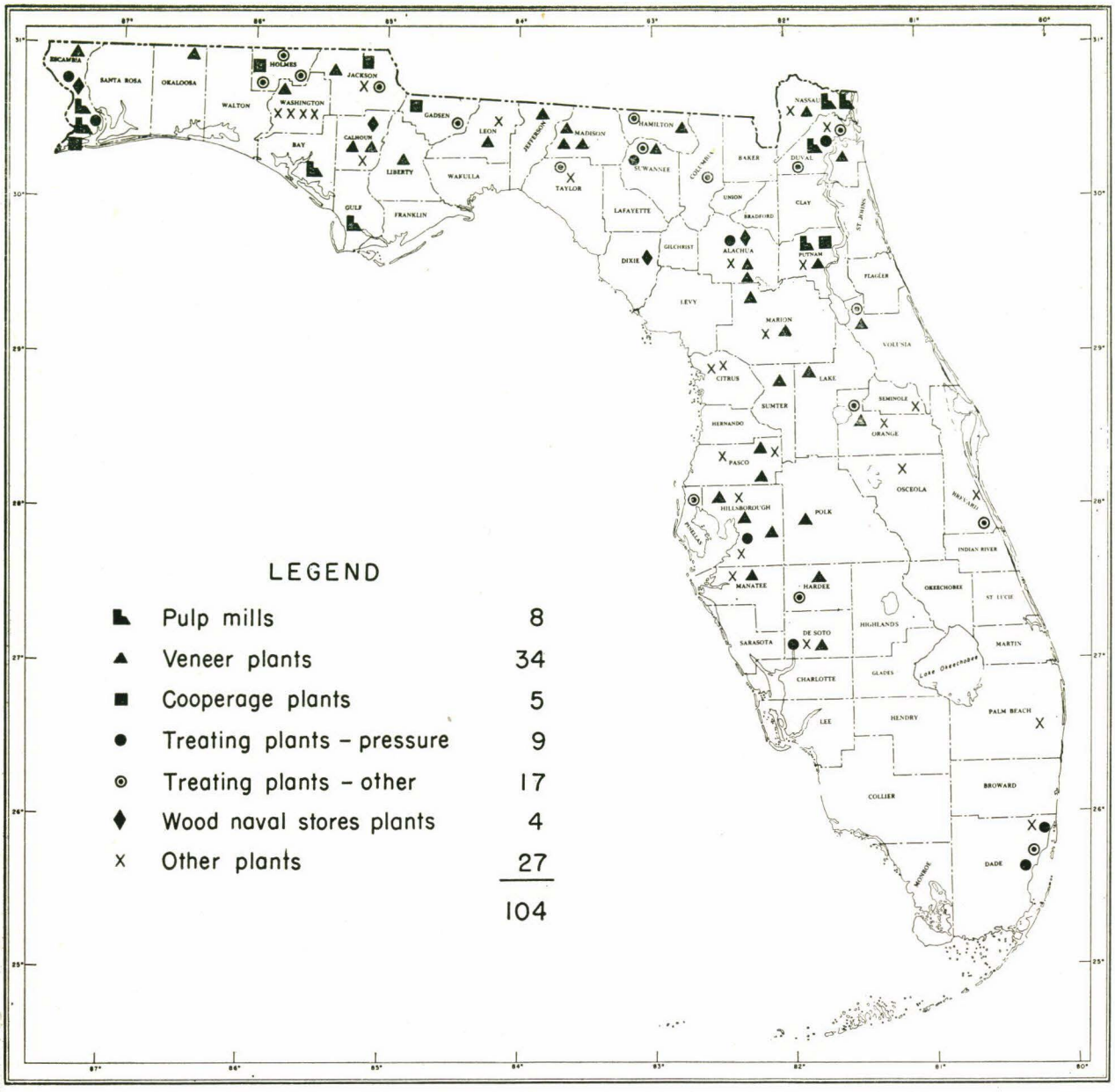

FIGURE 6.—*Location of primary wood-using plants in Florida, excluding sawmills, 1948.*

To a large extent, the pulp mills compete directly with the sawmills for the available supply of timber. All but a fifth of the pulpwood cut in 1948 was from trees of saw-timber size, i.e., pine trees 9.0 inches and larger, and half of it was from trees 11.0 inches and larger—the size of timber from which 90 percent of the sawlog volume is cut.

An increasing number of tops formerly left in the woods following logging operations are being used for pulpwood; in 1948 tops accounted for 15 percent of the total pulpwood production. In Florida, virtually all of the pulpwood is cut from pine.

Timber Used for Other Wood Products

Such products as fuel wood, fence posts, and farm timbers, which, for the most part, are cut on the farm for use by the farmer, constitute a very small drain on the forest. Although fuel wood accounted for 10 percent of the total volume cut for primary forest products in 1948, it accounted for less than

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FIGURE 7.—*In 1948, timber cut for pulpwood in Florida accounted for 38 percent of the commodity drain on the forest, nearly equalling the amount cut for sawlogs.*

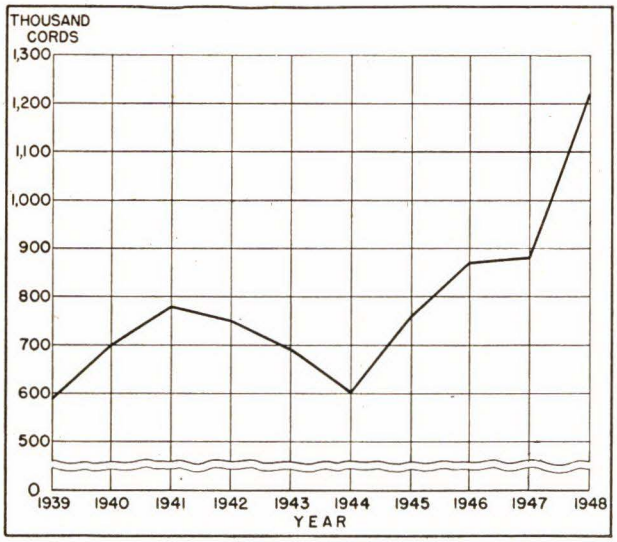

FIGURE 8.—*Pulpwood production, Florida, 1939-48.*

2 percent of the commodity drain on the forest. The reason for this is that only 13 percent of the 352,000 cords of fuel wood was cut from sound live trees of commercial species. Almost one-half was from dead material, mainly pine stumps, fallen branches, and dead trees. One-fourth of the fuel-wood production was from cull trees and scrub oak.

Wood is still the most used fuel for heating rural homes, but the use of other fuels is becoming increasingly common. Also, in recent years most of the tobacco farmers have converted to oil for tobacco curing. As a result, production of fuel wood in 1948 was only 27 percent as great as in 1936.

The production of all other wood products except pulpwood, poles, and piling followed the downward trend of lumber. Between 1936 and 1948, the production of veneer logs and bolts from Florida timber dropped 28 percent, the production of hewn

ties by 56 percent. Fence-post production fell off 39 percent.

The production of poles and piling has more than tripled since 1936, mainly because of the accelerated demand for poles in the construction of rural electric-transmission lines and the greater use of smaller poles.

Timber used by 27 miscellaneous plants in making a wide variety of products, such as handles, laths, shingles, and shuttle blocks, accounts for about 1 percent of the commodity drain on the forest.

Timber Used for Naval Stores

The production of naval stores does not constitute a commodity drain on what is normally regarded as the timber supply. However, this industry is an important part of Florida's forest products industries, and for this reason its supply of raw material needs to be considered in the over-all picture. Furthermore, naval stores operations greatly affect both growth and quality of pine timber in the State, as well as forest practices in general, and in this way indirectly influence the timber supply.

Naval stores include two primary products, turpentine and rosin. In the past, these were obtained entirely from the crude gum of slash pine and longleaf pine (fig. 9) and from pitch-soaked pine wood, including old-growth stumps. However, in fairly recent years an increasing quantity of sulfate turpentine is produced as a byproduct of the pulping process. In the naval stores season ending March 1950, 48 percent of the turpentine in the United States was produced from crude gum, 30 percent from pine stumps and lightwood, and 22 percent from pulpwood *(19)*. About 46 percent of the rosin is produced from crude gum and the remainder from dead pine wood *(19)*.

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FIGURE 9.—*The trend in gum production in Florida is downward. In the 1948-49 season only 14 million trees were being worked, compared to 36 million in 1936.*

Tall oil, a byproduct of the sulfate (Kraft) pulping process and a substitute for rosin, especially in the manufacture of soaps and in the processing of molds for metalworking, is an important recent addition to the family of naval stores products. Since 1944, the national production of tall oil has amounted to about 10 percent of the weight of rosin produced. An important part of this tall-oil production comes from the Kraft pulp mills in Florida *(22)*.

The total annual production of turpentine and rosin in the South has remained fairly constant since 1900. However, the amount produced from crude gum has steadily declined. In 1920, more than 90 percent of the turpentine and rosin produced in the United States was derived from crude gum *(26)*. In the late thirties the proportion dropped to less than 80 percent, and in the 1946-47 season it was below 50 percent. In Florida the production of turpentine from crude gum dropped from 8.3 million gallons in 1922 to 3.0 million in 1950 *(26, 19)*.

This decline in production is reflected in the reduced number of trees being worked for turpentine.

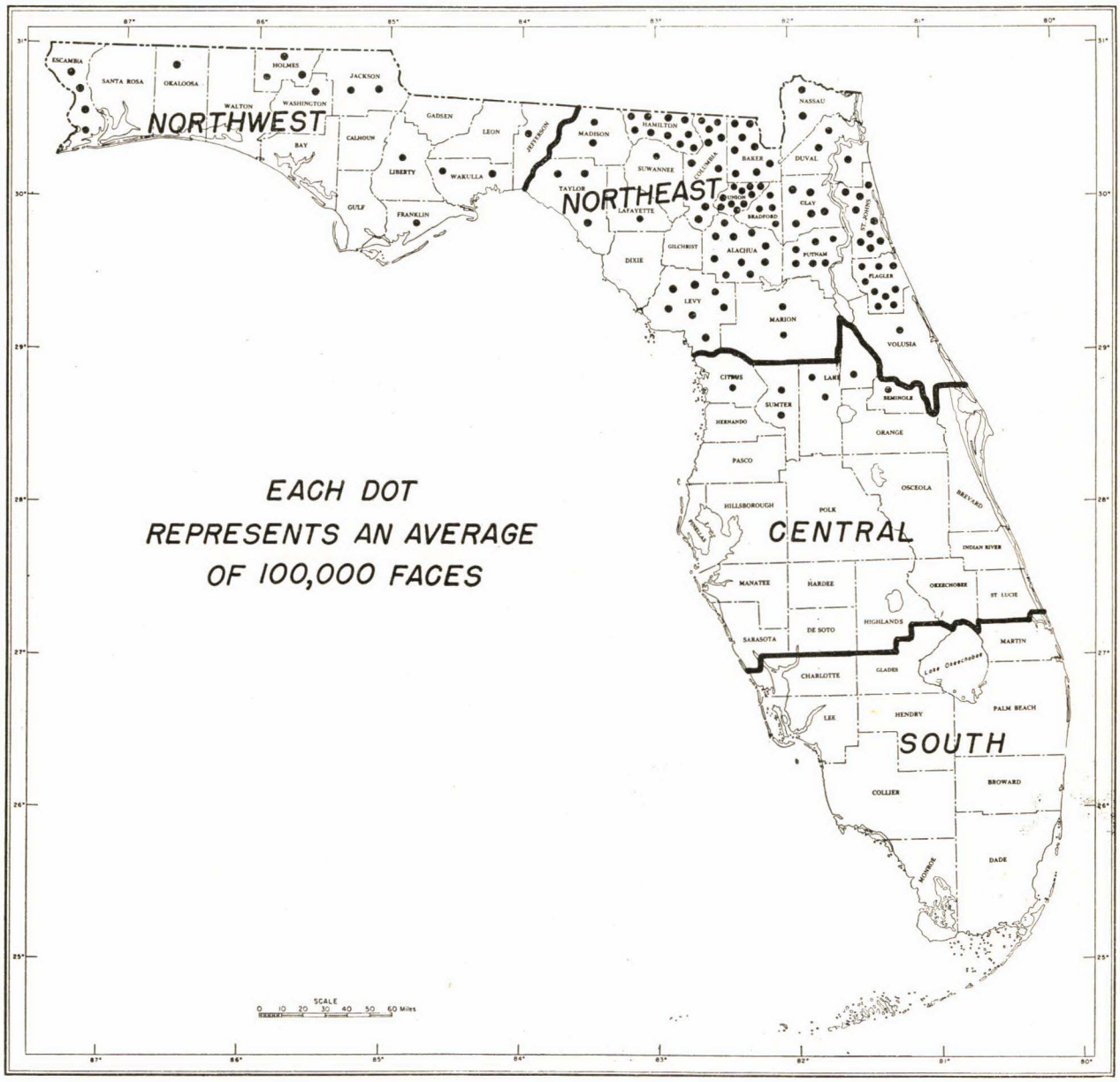

FIGURE 10.—*Distribution of working naval stores faces, Florida, 1949-50.*

In 1934–36, 36 million trees were faced in Florida; by the 1948–49 season, only 14 million trees were faced. During this period production has declined less in Northeast Florida (fig. 10) than in other sections of the State. Three-fourths of the working trees are now located there, compared to two-thirds at the time of the first Forest Survey.

Several factors contribute to the decline in gum production. One is the competition of the wood naval stores industry with the gum naval stores industry for relatively limited markets. Improvements in processing techniques along with the development of highly mechanized methods of extracting stumps have made it possible for the wood naval stores industry to market products approximately comparable in price and quality with products made from crude gum. At the same time, the cost of producing gum has gone up—especially the cost of labor, which accounts for two-thirds of the cost of making a barrel of gum *(21)*. To keep laborers from seeking work in the growing industrial sections, it has become necessary for gum producers to pay higher wages for a shorter working day. Also, the production of gum naval stores is not easily adapted to the alternate periods of oversupply and undersupply accompanied by extreme price fluctuations which characterize the naval stores industry. As wood naval stores industries captured a larger and larger share of the market, the production of crude gum became increasingly less attractive as a financial venture. In view of these developments, which have taken place in the past two decades, many gum producers decided to reduce their crops or turn to other occupations. The result has been a steady decline in the number of faces worked.

Two types of plants use old-growth longleaf and slash pine stumps, and other pitch-soaked wood. Destructive-distillation plants produce pine tar, pine oil, charcoal, and a small amount of turpentine by placing the wood in retorts and subjecting it to intense heat. Steam-distillation plants use chips from stumps and resinous stem wood, which is first steamed to remove the turpentine and other volatile oil and then boiled in solvents to remove the rosin. In 1948, there were three destructive-distillation plants and one large steam-distillation plant in Florida. These and plants outside the State used more than 700,000 tons of pine stump wood.

Florida's Timber Supply

Drain in Relation to Supply

ALL TOGETHER, Florida has more than 140 million cords of live timber 5.0 inches and larger (table 5). Not all of this volume, however, is equally well suited to filling rather specific timber needs of the forest industries. Almost a third of it has little or no commercial value, because more than half of the hardwood volume and a fourth of the cypress volume is in cull trees and in the top portion of saw-timber trees. This material may have a potential use for fibre or chemical products, but at present it is suitable mainly for fuel wood. Ninety-four percent of the live timber used for primary forest products in 1948 came from pole-timber trees, the sawlog portion of saw timber, and the upper stems of pine saw timber.

Pines are most heavily cut in relation to the supply. In 1948, the commodity drain on sound, live pine timber 5.0 inches and larger amounted to 4.5 percent of the growing-stock volume measured in cubic feet, compared with 1.6 percent for cypress and cedar and 1.3 percent for hardwoods.

The supply of large timber of all species is especially low in relation to the demand. Fifty-five percent of the commodity drain is on trees 13.0 inches and larger, but this size of timber makes up only a fourth of the inventory volume. Commodity drain on timber 13.0 to 19.0 inches was 6.2 percent of the volume of this size of timber, and on timber 19.0 inches and larger, 11.5 percent, compared to 3.1 percent for all growing stock 5.0 inches and larger. Much more large timber would be cut if it were available.

Much of Florida's saw timber is small and widely scattered. The largest remaining block of old-growth timber is in the cypress swamp in Collier County, and this area is being rapidly cut over. Of the total 20.6 billion board feet in Florida (table 6), two-thirds occurs in saw-timber stands. Only 13 percent of the total volume is in large saw-timber stands, which average around 5,500 board feet per acre. More than half of the saw timber is in small saw-timber stands averaging 4,000 board feet per acre and the remainder (a third) occurs as single trees or in small groups of trees scattered throughout the pole and sapling stands and poorly stocked areas (fig. 11).

Sixty-two percent of the saw timber is pine, 15 percent cypress, and the remainder, various hardwood species including water oak, sweetbay, blackgum and sweetgum. Most of this remaining hard-

TABLE 5.—*Volume of all live trees on commercial forest land by species group and kind of material, Florida, 1949*

Kind of material	Pine		Cypress and cedar		Hardwoods		All species	
	Million cords	*Percent*	*Million cords*	*Percent*	*Million cords*	*Percent*	*Million cords*	*Percent*
Saw-timber trees:								
Sawlog portion	27.9	46	6.3	33	10.2	16	44.4	31
Upper stem	6.6	11	1.6	8	2.4	4	10.6	7
Pole-timber trees	24.2	40	7.9	42	15.2	24	47.3	33
Cull trees:								
Sound[1]	1.2	2	1.3	7	22.7	36	25.2	18
Rotten	.2	1	1.8	10	13.0	20	15.0	11
Total	60.1	100	18.9	100	63.5	100	142.5	100

[1] Includes hardwood limbs.

TABLE 6.—*Net volume* [1] *of live saw timber by species group and stand-size clase, Florida, 1949*

Species group [2]	Large saw-timber stands	Small saw-timber stands	Pole-timber stands	Seedling and sapling stands	Poorly stocked stands and unstocked areas	All stands
	Million bd. ft.	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*
Pine	1,128	6,291	1,973	684	2,615	12,691
Cypress and cedar	244	2,292	373	95	182	3,186
Soft hardwoods	821	1,639	349	167	106	3,082
Hard hardwoods	455	647	280	109	144	1,635
Total, all species	2,648	10,869	2,975	1,055	3,047	20,594
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
All species	13	53	14	5	15	100

[1] Log scale, International ¼-inch rule.
[2] See appendix for species included in group, p 56.

wood timber is low quality. Average lumber-grade yields by log grades for common Florida hardwoods are shown in table 7. Only 12 percent of the hardwood volume is in select and Grade 1 logs. A third of it is in Grade 3A logs which will yield mainly poor-quality lumber, and over another third is in Grade 3B logs which are primarily suitable for cross ties and construction timbers.

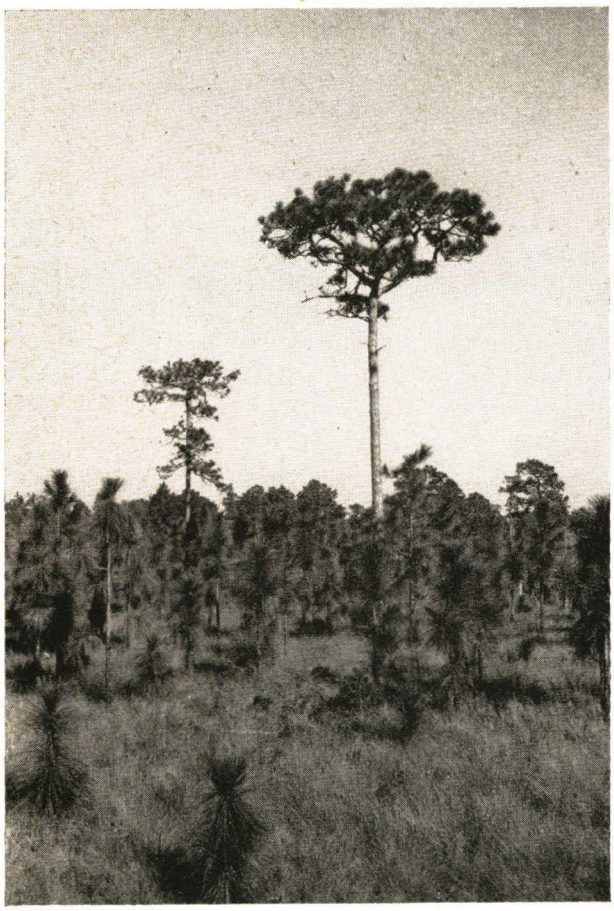

FIGURE 11.—*A third of Florida's saw timber is in trees scattered singly or in small groups throughout 18 million acres of sapling and pole stands and poorly stocked areas. (Photo courtesy Florida Forest Service.)*

Florida's timber supply is concentrated in the northern part of the State. With 63 percent of the commercial forest area, Northeast and Northwest Florida together have 80 percent of the State's saw timber and 78 percent of all growing stock.

The intensity of commodity drain on the timber supply likewise varies in different parts of the State. In 1948, it varied from 8.1 percent of the growing stock 5.0 inches d.b.h. and larger in Suwannee County to less than 1.0 percent in several counties—mainly in the lightly timbered counties in the southern part of Florida (fig. 12). Five counties, Suwannee, Duval, Pasco, Hillsborough, and Marion, with 8 percent of the growing stock in the State sustained 18 percent of the commodity drain.

TABLE 7.—*Florida hardwood lumber grade yields*

Lumber grade	Log grade				
	Select	1	2	3A	3B[1]
	Percent	*Percent*	*Percent*	*Percent*	*Percent*
FAS	35	30	11	2	----------
No. 1 Common	33	30	34	19	----------
No. 2 Common	15	21	27	39	63
No. 3 Common	17	19	28	40	37
Total	100	100	100	100	100

[1] It is expected that Grade 3B logs will be cut into ties, timbers, blocking, construction boards, etc., and not into standard grade lumber.

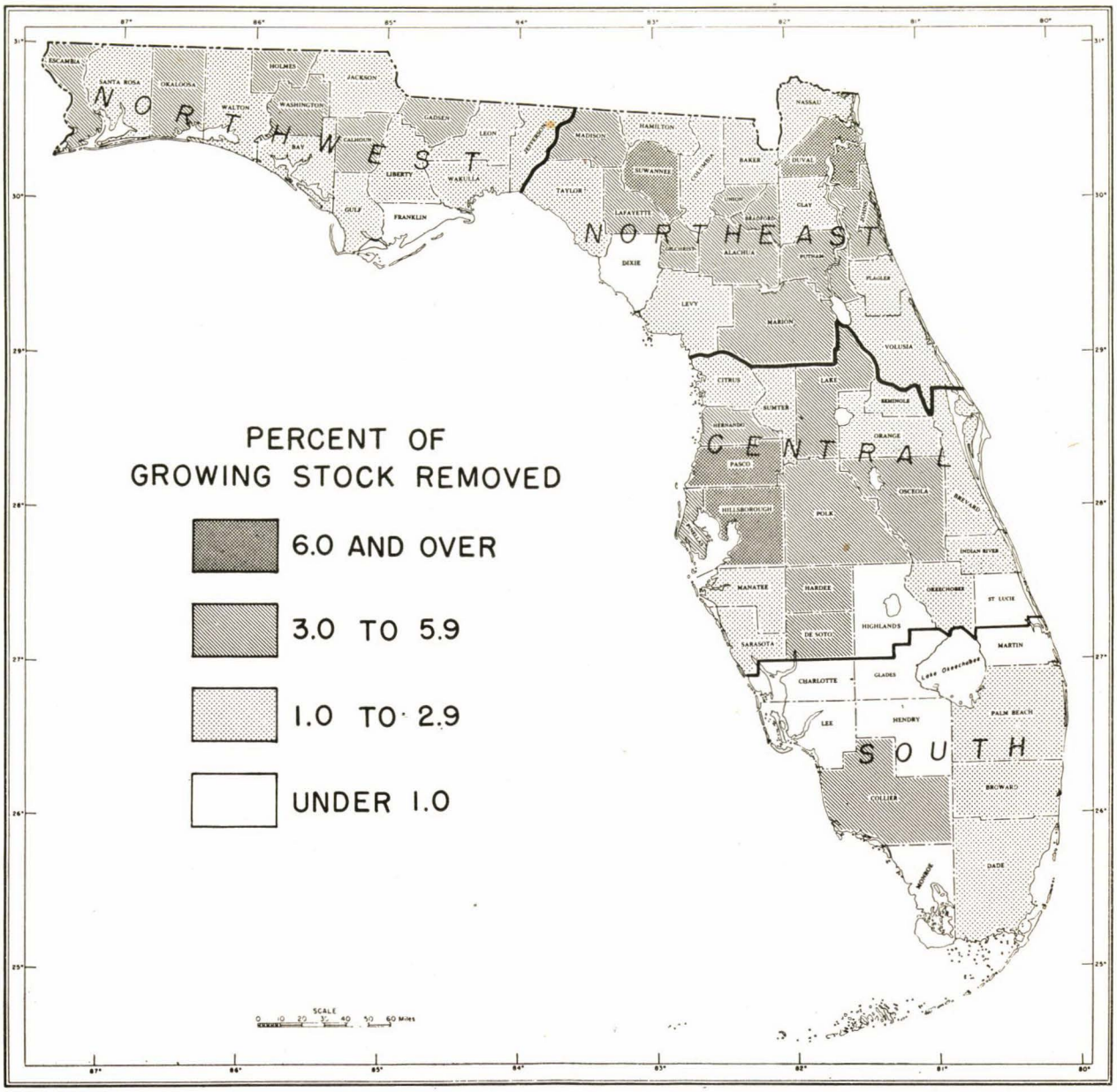

FIGURE 12.—*Percent of the growing stock (trees 5.0 inches d.b.h. and larger) removed as commodity drain in Florida, by county, 1948.*

Trends in the Timber Supply

In general, timber volumes by major species groups decreased throughout the State after the first Forest Survey in 1934–36 (fig. 13). The total volume of growing stock 5.0 inches and larger declined by 9 percent, saw-timber volume by 17 percent.[3] In spite of the intensive use of pine in relation to the supply, pine volumes in general have not suffered as much as cypress and hardwoods. For the State as a whole, total pine volume dropped only 4 percent compared to 14 percent for cypress and 15 percent for hardwoods. Pine saw-timber volume declined 9 percent, while cypress decreased 18 percent and hardwoods 36 percent.

Pine saw-timber volume in Northeast and North-

[3] Excludes volume of 12-inch hardwood trees, which were not considered saw timber at the time of the first Forest Survey.

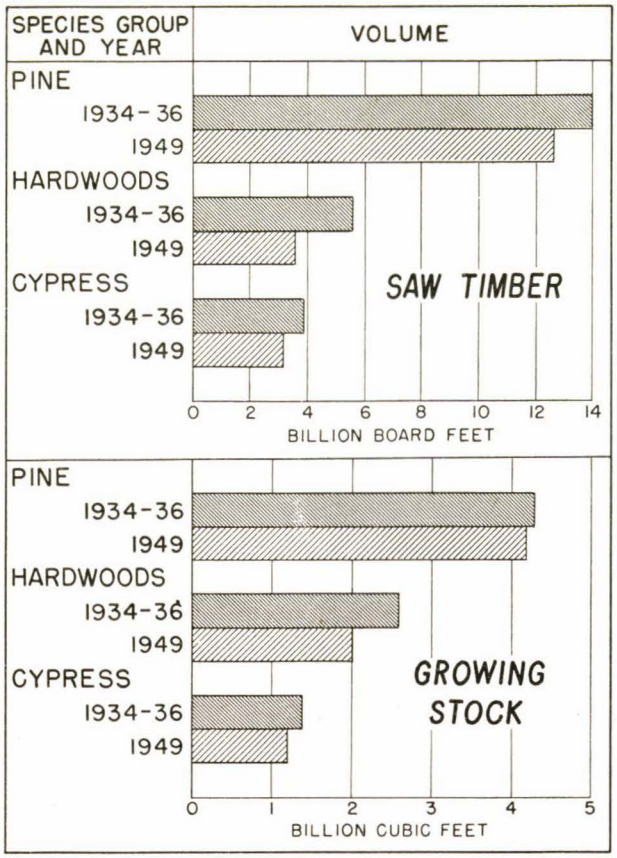

FIGURE 13.—*Volume of growing stock 5.0 inches d.b.h. and larger in Florida, by species group, 1934-36 and 1949.*

west Florida has not changed much. The volume of growing stock 5.0 inches and larger has remained about the same in the Northeast, but increased by 10 percent in the Northwest. Practically all of the decrease in pine volume occurred in the central and southern parts of the State. In these areas combined, pine saw timber dropped 36 percent; all pine timber, 25 percent. Undoubtedly, an important part of this drop in pine volume is the result of clearing forest land for pasture, citrus orchards, and other agricultural crops in Central Florida.

Cypress volumes decreased markedly in all parts of the State except in the central part, where both the total volume and the saw-timber volume increased by 20 percent. This increase is due in part to the rapid growth of small timber into commercial sizes during the 12-year period between surveys. These small second-growth trees do not, of course, yield the durable high-grade lumber usually desired when cypress is specified as a construction material.

Hardwood volume, like cypress, showed large decreases in all parts of the State except in the central part, where the volume has remained about the same.

Although timber volumes have decreased mainly because of heavy cutting, the increase in defective timber has also contributed to the decline of cypress and hardwoods. Many trees which qualified as sound trees at the time of the first survey have since become culls. The volume of hardwood culls has increased by 82 percent, cypress cull volume by 45 percent *(17)*. More hardwood cull volume is due, in part, to an increase of nearly 200 million cubic feet in the volume of scrub oaks, species which at the present time are used for very little except fuel wood. Another 200 million cubic feet can be attributed to the increase in volume of sound cull trees of other species. However, more than half of the increase was the result of more volume in rotten culls; many trees which contained some rot during the first survey have since become too rotten to qualify as sound trees. Growth has also increased the volume in cull trees.

In contrast to the reduction in timber which took place between surveys, a comparison of growth and commodity drain showed that during the year 1948 the saw-timber and pole-timber volume of pine, cypress, and hardwoods increased for the State as a whole (fig. 14). Growing-stock volume increased by about 2 million cords, and saw-timber volume by 188 million board feet. However, in certain areas commodity drain exceeded growth. Pine volume continued to decline in Central and South Florida and in Duval, Gilchrist, Holmes, and Suwannee Counties of North Florida (fig. 15). Commodity drain in excess of growth in Central Florida was partly a result of large-scale land clearing for citrus orchards and improved pastures; elsewhere it merely represented harvesting in excess of growth. While these growth and commodity drain comparisons are for a single year, they do suggest a reversal, temporarily at least, of the downward trend in timber volume.

This improvement in the growth and commodity drain balance is the result of an increase in the volume of growth coupled with a reduction in commodity drain (fig. 16). Between 1936 and 1948, annual saw-timber growth increased by 70 percent, and growing-stock growth more than doubled.

Most of the increase in growth took place in the pines. The large increase in pine growth was principally the result of a big increase in young pine timber. The number of 2- and 4-inch pines doubled between the two surveys; the number of pole-timber

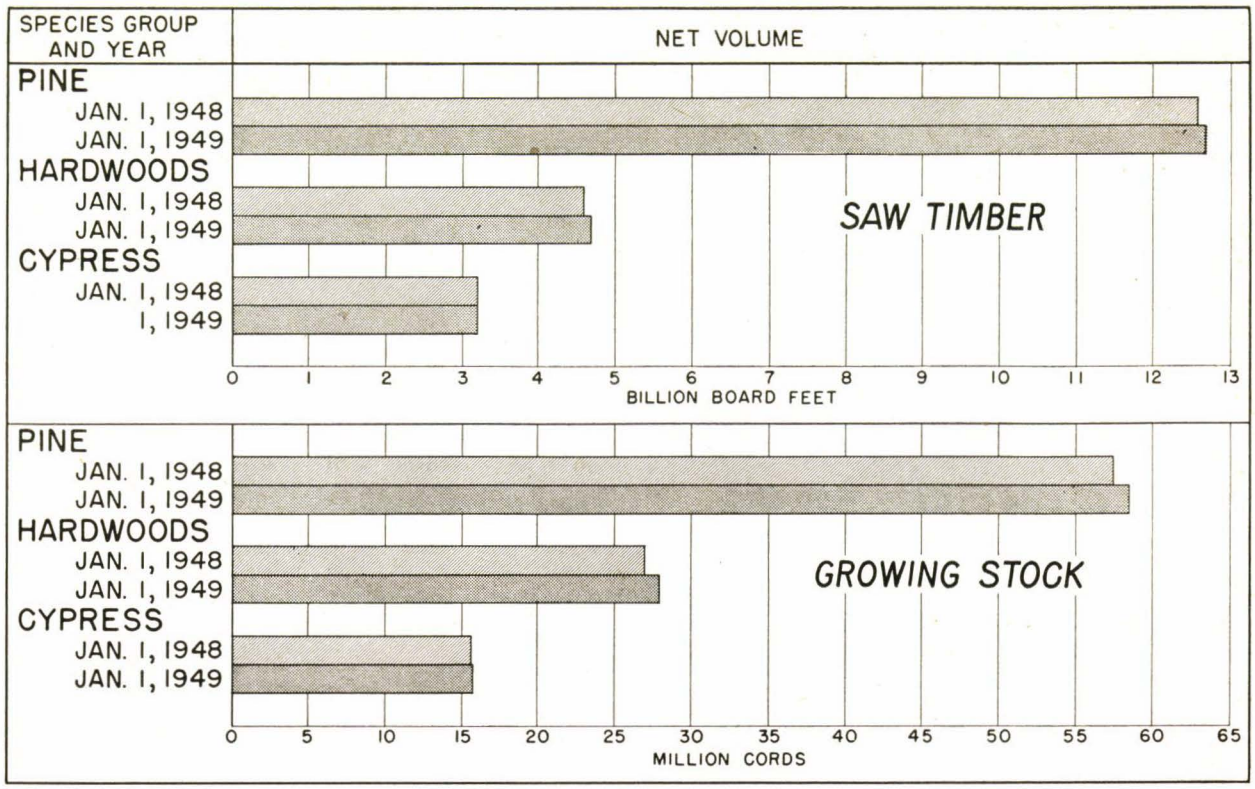

FIGURE 14.—*Change in net volume of saw timber and all growing stock in Florida, by species group, during the year 1948.*

trees increased 31 percent, and the number of 10-inch trees increased 24 percent. The importance of this increase in young timber is indicated by the fact that in 1948, 30 percent of the total pine saw-timber growth came from the recruitment of pole trees into saw timber; i.e., timber which at the beginning of the year had been pole timber was saw timber at the end of the year.

Also contributing to the increase in pine growth was the reduction in pine mortality stemming from better fire protection, turpentining fewer small trees, and better utilization of worked-out trees. In 1934–36 there were nearly 20 million worked-out trees compared to about 8 million in 1949. Pine mortality in 1948 was only 14 percent of what it was in 1936. Between surveys, commodity drain on saw timber dropped 36 percent and commodity drain from growing stock decreased 14 percent. Commodity drain on the primary growing stock declined less than saw-timber drain because of the increased use of small timber for pulpwood and poles.

Even though Florida is now growing more timber than is being cut, a large part of this growth is on trees which are not readily available to the industry. A fifth of the board-foot growth is on saw-timber trees scattered throughout seedling and sapling stands and poorly stocked areas. Saw-timber volume on these areas averages less than 500 board feet per acre. Another 16 percent of the saw-timber growth is on scattered saw-timber trees in pole-timber stands, which average around 800 board feet per acre. Timber in most of these stands is too scattered to be profitably logged at the present time. Also, while the greatest demand is for trees 12 inches and larger, most of the growth is on trees below this size. Finally, although the little-used hard hardwoods provide only 2 percent of the commodity drain, growth of these species accounts for 8 percent of the total growth. Thus, in spite of the large increase in growth, there is limited opportunity for immediate expansion by the forest industries.

Timber Supply for Naval Stores

The timber supply now available for the production of gum far exceeds any foreseeable demand for turpentine and rosin from the processing plants dependent upon Florida's forest resources. Exclusive

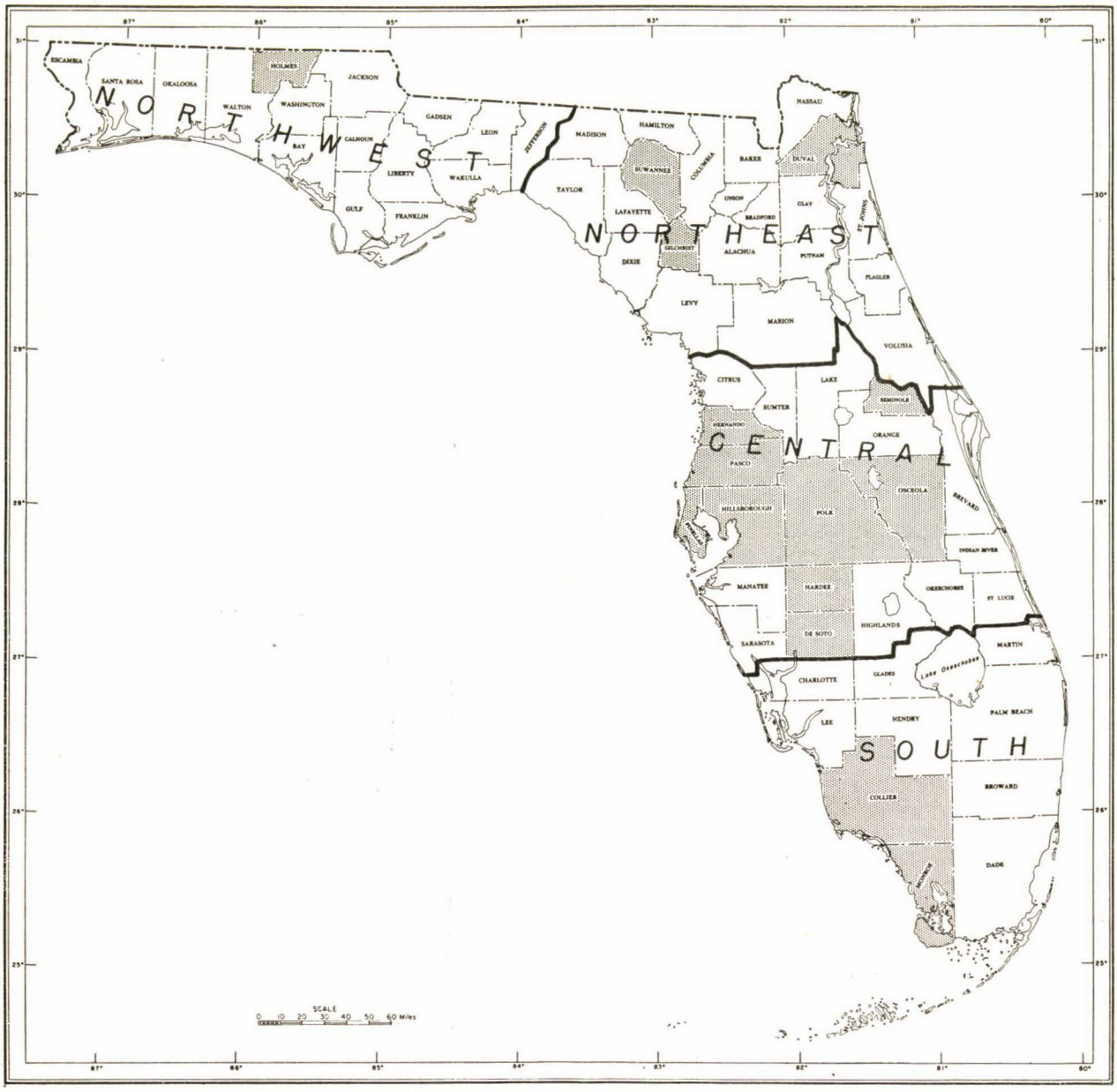

FIGURE 15.—*Florida counties in which commodity drain of pine 5 inches d.b.h. and larger exceeded growth during the year 1948.*

of South Florida, where the turpentine trees are generally too scattered for naval stores operation, the State has 11.6 million acres of turpentine pine type.[4] Only 5 percent of this area, 629,000 acres, was being worked for naval stores in 1949. Resting timber, i.e., front face worked out and back face not yet started, occupied an additional 514,000 acres. Another 1.5 million acres were stocked with stands of 15 or more round turpentine pines of working size per acre, in which no turpentining had been started. In these stands there are about seven times as many round pines of turpentine size as were being worked in 1949.

The remainder of the large acreage in the turpentine pine type consists of 458,000 acres of worked-out and abandoned timber and 8.5 million acres without enough turpentine pines of working size to make the stands operable. Some of these stands will become operable when the younger trees grow larger. How-

[4] Areas on which 25 percent or more of the number of dominant and codominant trees are longleaf or slash pine.

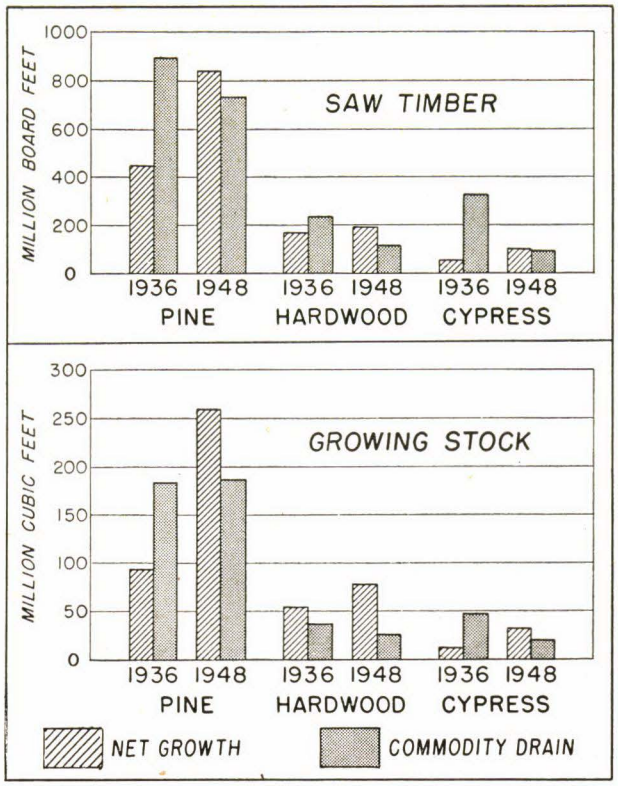

FIGURE 16.—*Net growth and commodity drain for saw timber and all growing stock in Florida, by species group, 1936 and 1948.*

ever, large areas have little but scrub oak on them and will not produce stands suitable for naval stores operations for many years, if at all, unless artificially reforested.

The future wood-supply outlook for the wood naval stores industry depends a great deal upon whether small stumps from second-growth trees and other less resinous wood can be used eventually. The old-growth stumps in Florida totaled nearly 30 million tons in 1949. Not all of this supply is available to the industry. Two percent is in inaccessible areas, 5 percent is unworkable at present because of the density of timber on the land, and another 4 percent is regarded as marginal, i.e., the stumps are on areas less than 25 acres in size or the areas have already been partially worked for stumps. Of the remaining 27 million tons of merchantable stump volume, only two-thirds is recoverable under existing practices. Thus only 18 million tons are readily available to the industry, or a 24-year supply at the present rate of use.

Considering all sources of naval stores products, such as pine trees, stumps, and pulping waste, there seems to be little danger of a shortage of raw materials in the foreseeable future. However, shifts in the importance of these various raw material sources will undoubtedly continue.

Forest Land Can Grow Much More Timber

ONE of the most significant facts revealed by the 1949 survey of Florida was the 70-percent increase in annual saw-timber growth and a doubling of the growing-stock growth compared to 1936. This increase in growth, coupled with the reduction in commodity drain, appears to have reversed the downward trend in volume; in 1948, growth of both saw timber and growing stock exceeded drain. The excess of growth over drain for all timber 5.0 inches and larger was 2.2 million cords. The expansion under way in pulping capacity is expected to add around 1,116,000 cords to the commodity drain. Even with this anticipated increase in drain, there will still be a substantial margin of growth over drain. This growth and drain picture is in sharp contrast to what it was in 1936 when drain on all sizes of timber exceeded growth by 68 percent and drain on saw timber was more than double the growth.

It would be a mistake, however, to conclude that all of the remaining surplus growth is available for expansion in timber use at this time. For one thing, as pointed out before, much of the growth is on young and scattered timber which will not be ready for harvesting for many years. Also, the turn for the better in Florida has taken place at a very low level of forest productivity, so that much of this surplus growth is needed to build up Florida's badly depleted stock of timber.

If adequately stocked with timber, Florida's forest land could grow 2½ times as much timber as it is now growing. In 1948, the annual growth per acre of commercial forest land was 65 board feet of saw timber, or 0.3 of a cord of all timber. Even though a large part of this land is rather poor from a timber-producing standpoint, with only a moderate improvement in forest practices, the annual growth could easily be increased to 150 board feet, or 0.6 of a cord per acre.

Two-Thirds of Land is Forested

In 1949, 62 percent, 21.5 million acres, of the total land area in the State was classed as commercial forest land (fig. 17). An additional 4 percent, 1.5 million acres, was called noncommercial because it was too infertile or too wet to grow timber of commercial size. Only 10 percent was in active agricultural use. Land previously cultivated but now idle or abandoned amounted to 1.1 million acres. About 416,000 acres of this is in Northeast Florida where timber-growing sites are good enough to justify planting to pine. By far the largest part of the remaining land in the State is marsh, some of which is used for cattle grazing.

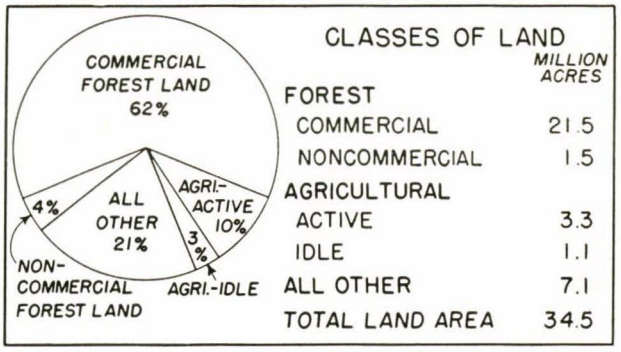

FIGURE 17.—*Land area of Florida, by broad use class, 1949.*

The northern part of the State is most heavily forested (fig. 18). All but 8 of the 37 counties in this area have 75 percent or more of their area in commercial forest land. A number of counties, Baker, Liberty, Flagler, Clay, and Calhoun, are more than 90 percent forested.

Citrus, Hernando, Pasco, and Orange Counties of Central Florida also contain a high proportion of commercial forest land. Southward, in the vicinity of Lake Okeechobee and along the east coast, commercial forest land is replaced, in large part, by treeless prairies and marshes and by nonproductive forests composed of stunted trees and shrubs. Only 28 percent of the area south of Lake Okeechobee is commercial forest land and most of it is basically low in productivity; present conditions of repeated burning make the land even less productive.

The area of forest land has changed very little

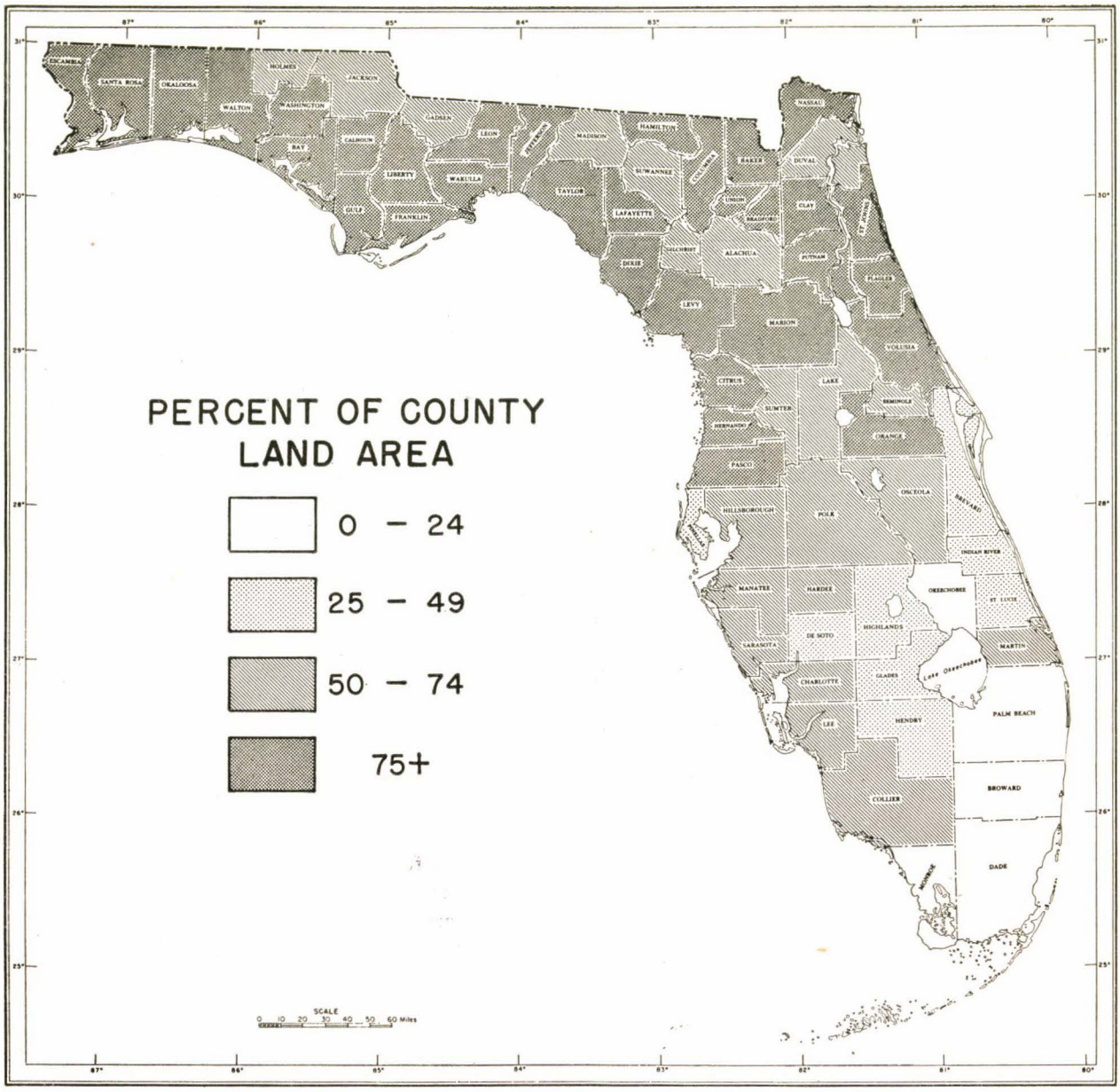

FIGURE 18.—*Percent of land in commercial forest in Florida, by county, 1949.*

since the 1934–36 survey. For the State as a whole, commercial forest land decreased by 2 percent. In all but the central part changes have been less than 2 percent. Here the 7-percent decrease—almost a half million acres—in commercial forest land is partially the result of land clearing for citrus, pasture, and other agricultural uses. In view of the growing demand for frozen citrus products, it is reasonable to expect a further reduction in forest acreage in Central Florida. The natural and artificial restocking of idle land in the Northeast could easily compensate for this loss, however, so no significant change in the total commercial forest area of the State is probable in the near future.

Pine Forests Most Abundant

Florida has many different kinds of forest land covered with a wide variety of forest types, but nearly three-fourths of the forest is pine (table 8), with longleaf and slash the leading types. Potentially, these pine lands can grow much greater quantities

of pine pulpwood, poles, and sawlogs for the raw material of industry.

More than one-half of the forest land is flatwoods, low, level, poorly drained areas chiefly confined to broad belts flanking the Atlantic Ocean and the Gulf of Mexico. The flatwoods are dominated by slash pine and longleaf pine and are dotted with many small cypress ponds. Inward from the flatwoods are the low rolling uplands, extending across northwestern Florida and as a central ridge down the peninsula nearly to Lake Okeechobee. These uplands are covered principally with longleaf pine and scrub oak in pure and mixed stands. Both slash and longleaf pine occur on the wetter parts of the rolling uplands. Good stands of hardwoods, often mixed with pine, grow on the sandy-loam areas, such as those north of Tallahassee and near Gainesville. Both the flatwoods and the rolling uplands are broken by numerous streams, swamps, and shallow ponds. These lowlands are the habitat of cypress, and a variety of hardwoods, including sweetgum, black and water tupelo, sweetbay, magnolia, and numerous species of

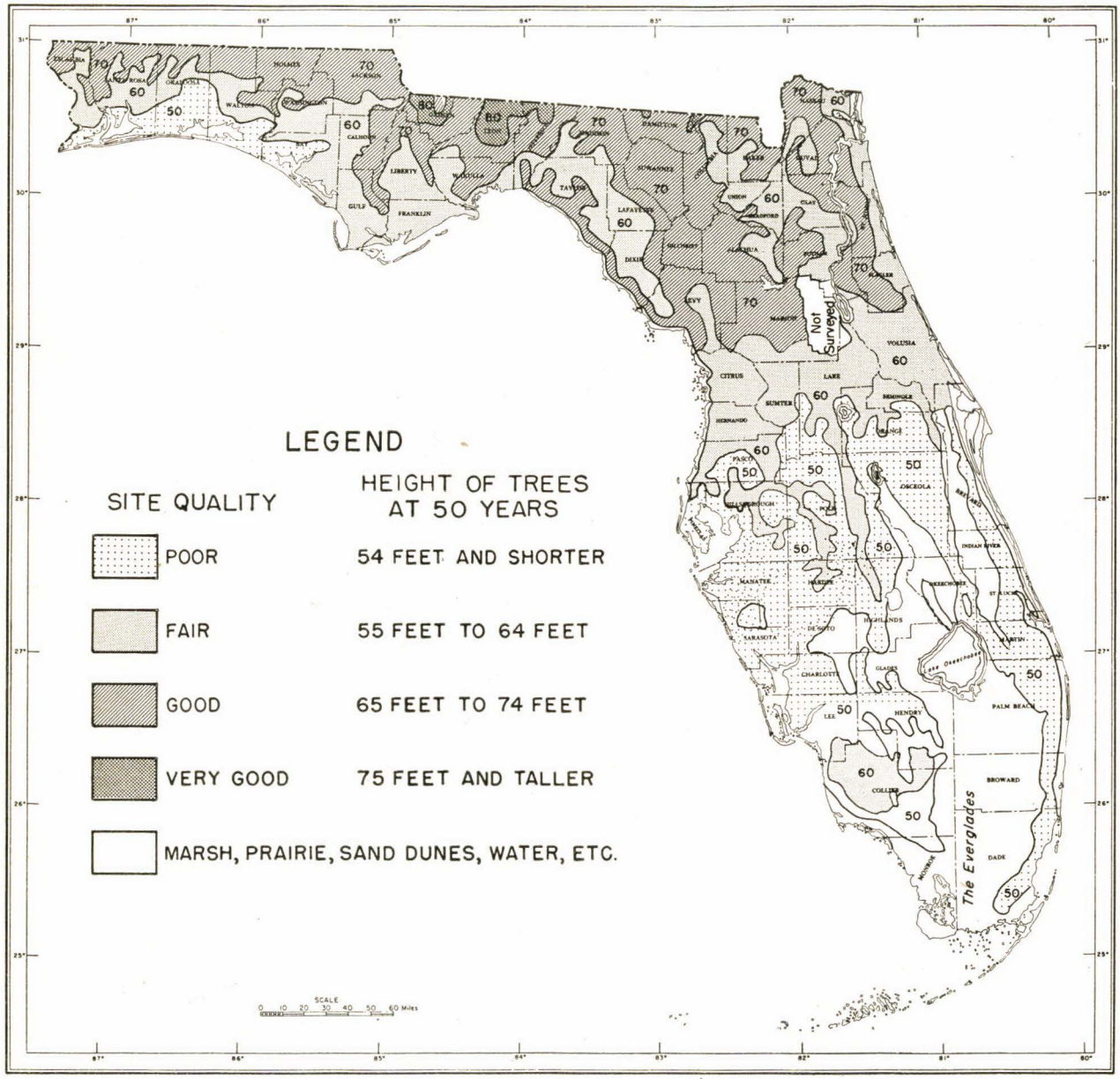

FIGURE 19.—*Site quality of the pine land in Florida.*

TABLE 8.—*Area of commercial forest land by forest type and location, Florida, 1949*

Forest type [1]	Northeast	Northwest	Central	South	Florida total
	Million acres	*Million acres*	*Million acres*	*Million acres*	*Million acres*
Longleaf pine	2.3	2.4	2.5	0.1	7.3
Slash pine	1.9	1.3	1.1	1.7	6.0
Loblolly pine [2]	.3	.4	----	----	.7
Pond pine	.2	.1	.1	----	.4
Sand pine	.2	.1	.1	----	.4
Cypress	.6	.1	.3	.3	1.3
Lowland hardwoods	1.1	.8	.8	.1	2.8
Upland hardwoods	.3	.1	.2	----	.6
Scrub oak	.7	.6	.6	----	1.9
Palms	----	----	.1	----	.1
All types	7.6	5.9	5.8	2.2	21.5

[1] See description of forest types in appendix, p. 55.

[2] Includes 29,100 acres of shortleaf pine type and 20,600 acres of redcedar type.

TABLE 9.—*Quality of commercial forest land by forest types, Florida, 1949*

Forest type	Area	Quality of forest land		
		Poor	Fair	Good
	Million acres	*Percent*	*Percent*	*Percent*
Longleaf pine	7.3	55	25	20
Slash pine	6.0	47	24	29
Loblolly pine [1]	.7	5	15	80
Pond pine	.4	(2)	(2)	(2)
Sand pine	.4	(2)	(2)	(2)
Cypress	1.3	18	52	30
Lowland hardwoods	2.8	17	57	26
Upland hardwoods	.6	66	32	2
Scrub oak	1.9	(2)	(2)	(2)
Palms	.1	(2)	(2)	(2)
All types	21.5	43	31	26

[1] Includes 29,100 acres of shortleaf pine type and 20,600 acres of redcedar type.

[2] Land not classified, but generally is poor-quality forest land.

oak. The low prairie lands east and west of the Everglades support still another kind of forest. Open stands of slash pine grow on the higher and usually better-drained flatlands, while cypress dominates the many ponds and swamps.

Half the Forest Land Fair to Good Quality

About one-half of Florida's commercial forest land, 10.7 million acres, is rated fair to good for timber-growing purposes (table 9, fig. 19). Fair sites are capable of growing pine trees 55 to 64 feet high in 50 years, and hardwood trees with two merchantable 16-foot logs when mature. On good sites, pines will attain a height of 65 feet or more in 50 years, and hardwood trees will have at least three merchantable logs when mature.

Two-thirds of the fair and good timberland supports pine forests. Over half of this land is rated good timber-growing land. In 60 years this kind of land, when fully stocked, will have a stand of about 17 thousand board feet per acre. This is an average annual yield of 280 board feet (fig. 20). On the average, the remaining fair-quality pine land will yield about 10 thousand board feet per acre in 60 years, an annual yield of about 160 board feet. Potential pulpwood yield in 40 years varies from three-fourths of a cord per acre per year on fair sites to about one cord on the good sites.

Three and a half million acres of fair and good land support hardwood and cypress forests. About a third of this area is rated good quality. Here the mature trees normally have a merchantable length

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FIGURE 20.—*Florida has 3.8 million acres of good pine timberland which, when well stocked, can grow about 280 board feet per acre per year on a 60-year rotation.*

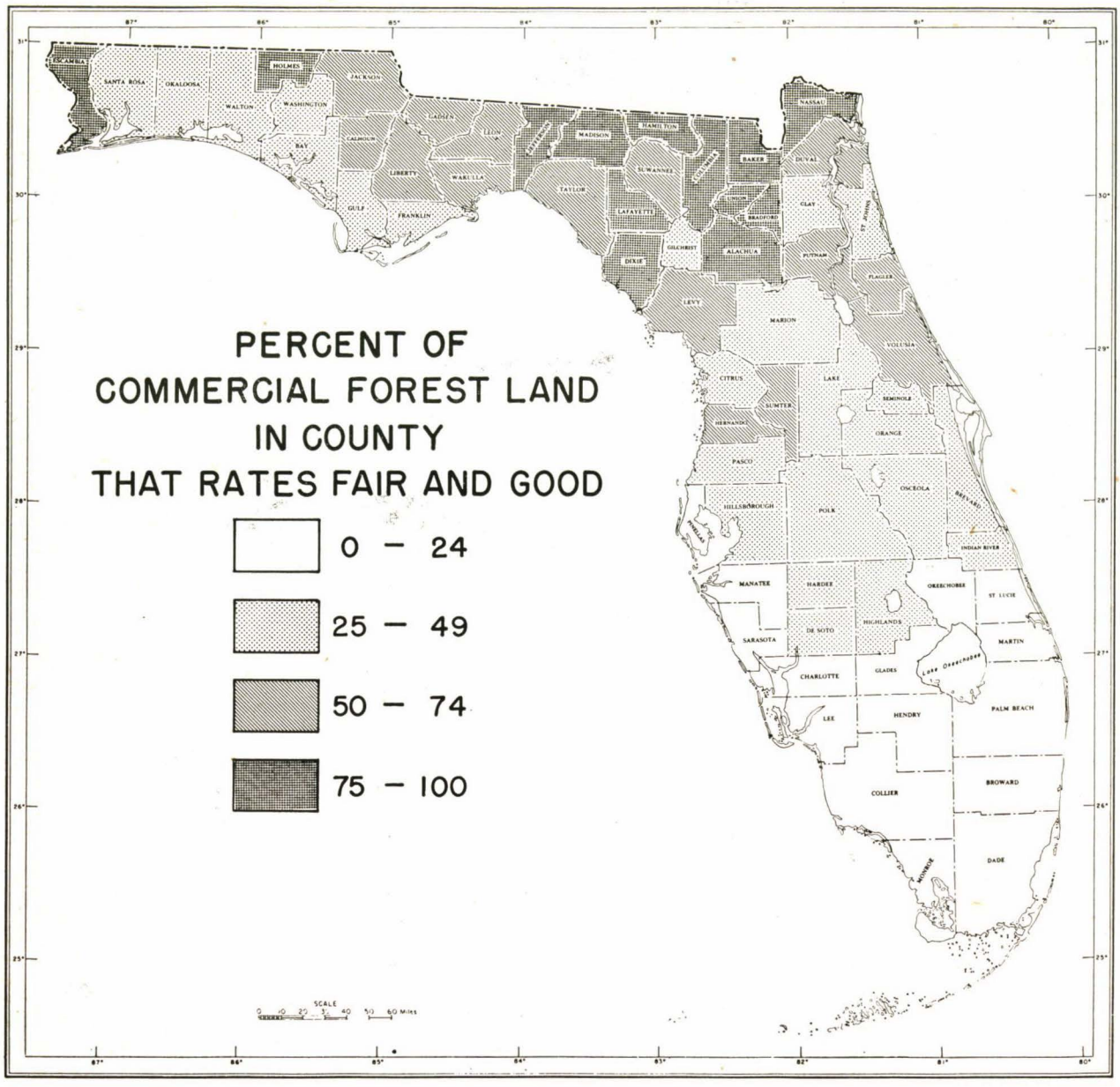

FIGURE 21.—*Distribution of fair and good timber cropland in Florida, by county, 1949.*

of at least three logs. Such sites are usually found on bottoms or well-drained deep soils such as are frequently used for agricultural purposes, but good stands of cypress and water tupelo often occur in the deepest and wettest swamps.

The most productive forest land occurs in the northeastern part of the State (fig. 21). Here the quality of a large part of the forest land compares favorably with the best in the South. In a group of 11 counties, 75 percent or more of the commercial forest land is rated fair and good, and in Hamilton and Union Counties over 95 percent.

On the other half of the commercial forest land in the State, possibilities for growing timber are more limited under present conditions. Approximately half of the longleaf and slash pine types are on poor-quality forest land. This is land which is not capable of growing pine trees taller than 54 feet in 50 years (fig. 22). Growing saw timber on these sites is a slow process; even when well stocked it takes

FIGURE 22.—*About 7 million acres of slash and longleaf pine in Florida are on poor-quality forest land, which has limited timber-growing possibilities. (Photo courtesy Florida Forest Service.)*

about 100 years to grow 10 thousand board feet per acre on the best of these areas. This amounts to a mean annual growth of only 100 board feet. Many areas are not so productive as this; areas such as the dry oak ridges and some of the poorly drained flats with an underlying hardpan are so poor that even old-growth trees seldom exceed 12 to 14 inches in diameter.

The prospect of growing pulpwood timber on a short rotation on these poor sites is better. Pine on many of these sites makes fairly rapid growth for the first 30 or 40 years. When fully stocked they could be expected to grow from 15 to 20 cords of pulpwood per acre in 40 years or, on the average, nearly a half cord per acre per year. The big problem is to keep these poorer sites stocked with timber.

More than half of the area of slash pine type growing on poor-quality forest land is in South Florida; another 19 percent is in the central part of the State. Four-fifths of the longleaf pine on poor sites is on dry, sandy ridge land in Northwest and Central Florida.

In addition to the longleaf and slash pine on poor land, there are 770,000 acres of pond and sand pine which, in general, have rather low timber-growing potentialities. Also, nearly two million acres of dry, sandy ridge land are covered with scrub oak (fig. 23). A large part of this area once had fair stands of longleaf pine. If some way could be found to eliminate the scrub oak cheaply, the land could be planted and much of it could be expected to grow from a fourth to a half cord of pulpwood per acre per year and a limited amount of small sawlogs.

Less than a fifth of the cypress and lowland hardwood types is on poor-quality forest land. This is land on which mature hardwood trees on the average do not have more than one merchantable 16-foot log in them.

In addition to the commercial forest land, in 1949 Florida had more than a million acres of idle agricultural land. Some of this, of course, soon may go back into agricultural production, but a substantial part will never be cultivated again and is available for timber production. Much of this abandoned cropland has good timber-growing possibilities. Many 13- to 15-year-old slash pine plantations in Florida show an average growth of more than 2 cords per acre per year.

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FIGURE 23.—*Much of the nearly two million acres of Florida's scrub oak land could be made to produce pine again if a way could be found to eliminate the scrub oak cheaply.*

Timber Yields Could Be Greatly Increased

In spite of the fact that so much of Florida's commercial forest area is poor quality, the State has tremendous timber-growing possibilities. It has 7 million acres of fair- to good-quality pine land which, if fully stocked, is capable of growing 1,600 million board feet a year. Current pine growth is only 837 million. Looking at it another way, this area alone is capable of growing enough additional pine timber to double the amount used for both lumber and pulpwood production in 1948.

This potential growth leaves out entirely the possible growth on 7 million acres of poor longleaf and slash pine sites, the growth on nearly 800 thousand acres of sand and pond pine land, and on 2 million acres of poor upland hardwood and scrub oak land. If fully stocked, this area could grow as much as 900 million board feet of pine sawlogs, or 4.5 million cords of pulpwood a year. Of course, per-acre yields on much of this land probably would not justify the intensive management that would be required to keep this land fully stocked. Yet, even if this land averaged only 50 percent stocked, it could be expected to contribute a fourth of a billion feet of sawlogs, plus a million cords of pulpwood to Florida's annual timber needs.

In addition to this pine-producing land, the State has 3.5 million acres of fair to good land supporting hardwood and cypress timber which is estimated to be capable of growing annually 750 million board feet. This is 2½ times current growth and 3½ times current use.

In short, Florida could grow two to three times as much timber as it is now growing. Producing near capacity, the State's forest land could grow enough timber to support 170 additional medium-size sawmills (annual production of 5 million board feet) or 20 additional medium-size pulp mills, plants with capacity of 100,000 tons of pulp a year. Further, the hardwood-using industry could be expanded 4 or 5 times its present size.

Forests in Poor Condition to Grow Timber

More Than Half the Forest Land is Poorly Stocked

THE poor condition of the forest growing stock, rather than a lack of productive capacity of the forest land, keeps Florida from growing more timber. The main reason why timber growth is so low in Florida is that so much of the forest land is lying idle when it could be growing trees. In 1949, 12.4 million acres, 58 percent, of the forest land was either unstocked or poorly stocked with sound trees of commercially valuable species. Some of this land, of course, is recently cut-over land and other land which can be expected to restock naturally in a reasonable time if protected from repeated wildfires. However, 7.1 million acres do not have enough seed trees to insure reasonably prompt natural restocking. Four-fifths of this large area without adequate seed trees is poor-site land (fig. 24); 3.7 million acres is pine types and 1.9 million is upland hardwood and scrub oak types. Virtually all of the land without enough seed trees on the fair and good sites, 1.5 million acres, is slash and longleaf pine land.

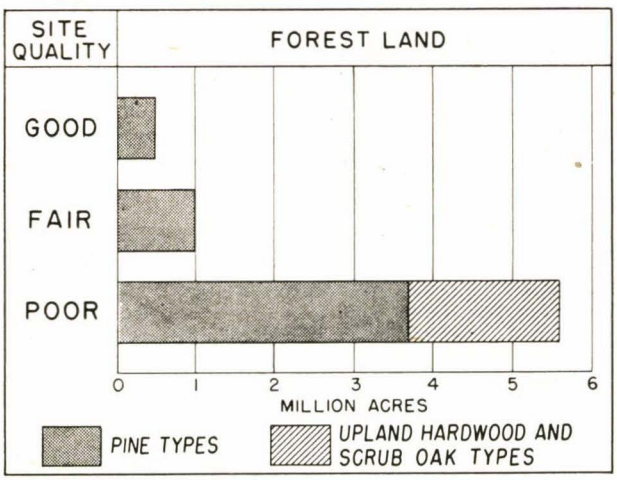

FIGURE 24.—*Distribution of poorly stocked land without adequate seed trees, by site quality and forest type, Florida, 1949.*

The poorly stocked forest land without seed trees is distributed throughout the State but is especially prevalent in Central and South Florida and in several counties of Northwest Florida. Over half, 3.8 million acres, of the total lies in the central and southern part where much of the forest land is poor in site quality. Another three-fourths of a million acres are on the dry sand ridges of Okaloosa, Walton, Washington, and Calhoun Counties west of Tallahassee.

The distribution of the nonrestocking forest land on the fair and good sites differs from that on the poor sites. This 1.5 million acres, which would rate first priority in a planting program, lies almost entirely north of Lake Okeechobee and occurs only sparingly in the western part of the State. About 700,000 acres are in Northeast Florida.

More Than a Third of the Live Trees Are Culls

A serious obstacle to natural restocking and planting alike is the large number of low-grade trees on many areas (fig. 25). In 1949, 37 percent of all the live trees in the State were culls. These are trees which are so rotten or so rough and deformed that, at the present time at least, it would not pay to cut them for sawlogs. They also include the trees under saw-timber size that are so defective and deformed that they show no promise of ever becoming merchantable for sawlogs. Various species of oak, mainly scrub oak, make up the largest share of the cull trees (fig. 26). As pointed out previously, some of these poor-quality trees are suitable for pulpwood or fuel wood. However, they greatly reduce stand productivity by taking up space that could be occupied by trees of more desirable form and species.

Mainly because of the dense stocking of scrub oaks, large areas of the dry, sandy ridge land which formerly grew commercial stands of longleaf pine have completely failed to restock following cutting. For the same reason, even where an adequate seed

FIGURE 25.—*Many areas remain unproductive because cull trees prevent young trees of desirable form and species from becoming established. (Photo courtesy of Florida Forest Service.)*

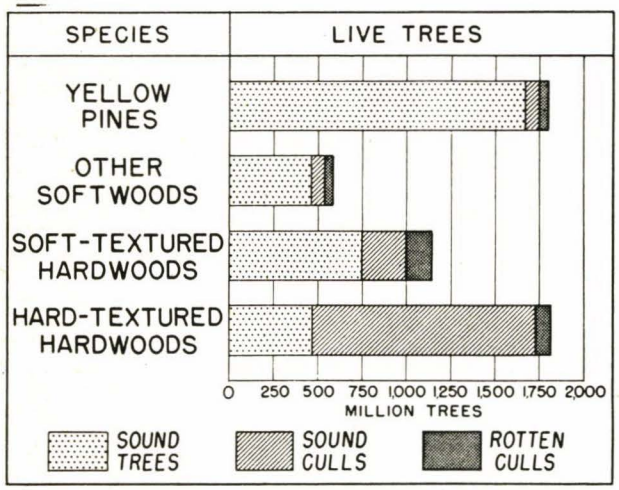

FIGURE 26.—*Number of trees, by quality class and species group, Florida, 1949.*

source is present, restocking with pine is taking place very slowly over much of the longleaf pine type. Nearly half of all the cull trees in the State are on these dry sites in longleaf pine, upland hardwood, and scrub oak stands.

Of the cull trees under 5.0 inches d.b.h., only the scrub oak species were recorded. Other small trees and shrubs of low value which frequently hinder the establishment of desirable tree species include wax-myrtle, ironwood, sassafras, gallberry, titi, button-bush, and palmetto.

Heavy cutting of the best-quality trees and most valuable species has left the lowland hardwood and cypress stands with a large proportion of large cull trees in them. Nearly two-thirds of all the live hard-wood trees 13.0 inches and larger in the State are culls.

Shortage of Large Timber

Another undesirable condition which is general throughout Florida is the striking shortage of large timber (fig. 27). A small number of large trees in relation to the number of small trees is a normal

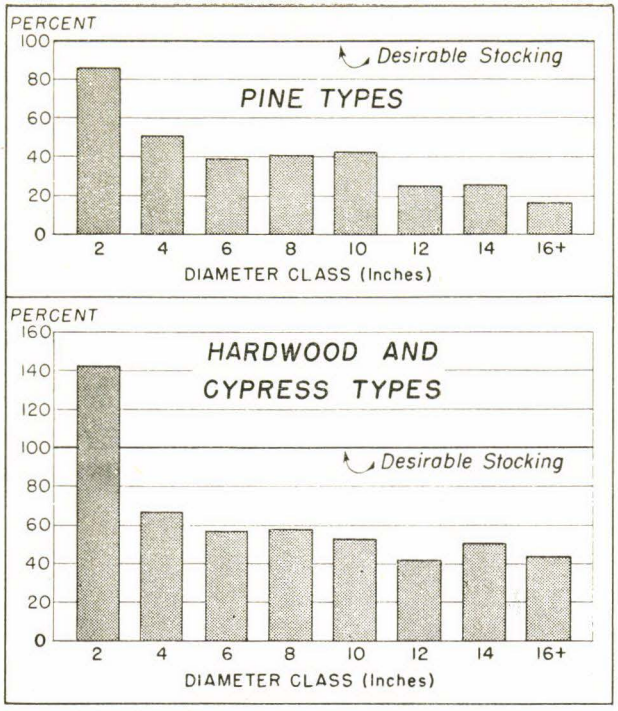

Figure 27.—Comparison of actual with desirable stocking of sound trees, by diameter class and forest type, Florida, 1949.

condition even in well-managed forests, but the number of trees 11.0 inches and larger (all species) should make up about 9 percent of the total number of trees 1.0 inch and larger.[5] In Florida, however, trees 11.0 inches and larger make up only 3.6 percent of the total in pine types and 4.9 percent in hardwood and cypress types.

Perhaps even more significant than the present shortage of large timber is the trend in volume (fig. 28). The number of trees 13.0 inches and larger decreased for all species throughout the State since the first forest survey. The number in the 10-inch class increased mainly because of the large ingrowth of young trees into this size class. The number of trees in the 12-inch class did not change much. At the time of the first survey the average volume per tree of all pine trees 9.0 inches and larger was 89 board feet; in 1949 it was 77 board feet—a 13-percent decrease. The average volume of hardwood trees 13.0 inches and larger[6] was 126 board feet in 1949—23 percent less than at the time of the first survey.

[5] Based on stocking standards used by the Forest Survey. See appendix, p. 56.

[6] Hardwood trees in the 12-inch class were not recorded as saw timber at the time of the first survey, so no comparison of trees smaller than 13.0 inches is possible.

Smaller timber means lower board-foot yields. Yield studies *(27)* show that the average annual growth per acre for a 30-year-old fully stocked slash pine stand 7 inches d.b.h. and over (site index 70) is 267 board feet (International Rule), compared to 410 board feet for a 50-year-old stand. Thus, annual saw-timber growth could be increased by merely letting the trees grow larger before cutting them.

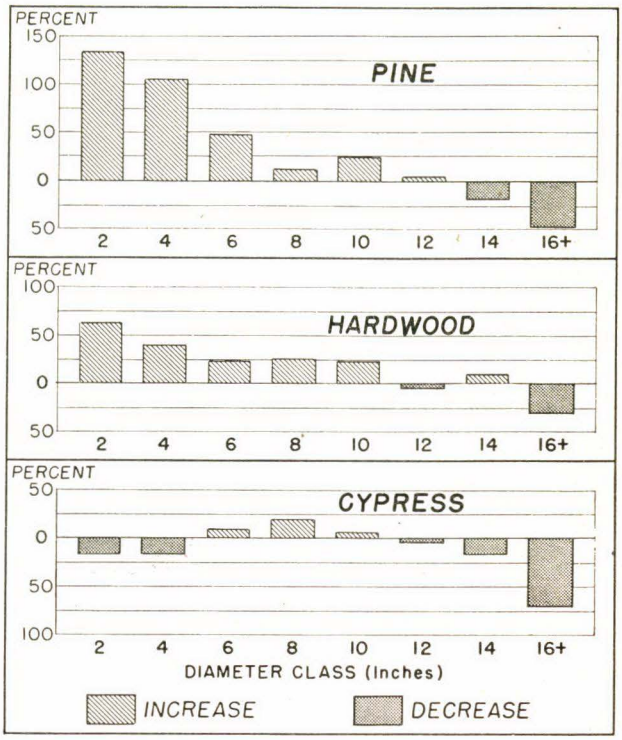

FIGURE 28.—*Change in number of trees, by diameter class and species, Florida, 1934-36 to 1949.*

The board-foot difference arises mainly because such a large part of small trees, when sawn into lumber, goes into sawdust, slabs, and edgings. In cubic feet, in stands 2 inches d.b.h. and over, the average annual growth of a 30-year-old stand exceeds that of a 50-year-old stand.

Pine Types Decreasing, Hardwoods Increasing

Between 1934–36 and 1949, the area of pine types decreased by 2.3 million acres, a 14-percent reduction (fig. 29). This was accompanied by a considerable increase in the number of hardwood saplings and poles and in the number of cull hardwoods.

A good deal of the decrease in pine types has taken place on the dry, sandy sites. Poor site quality

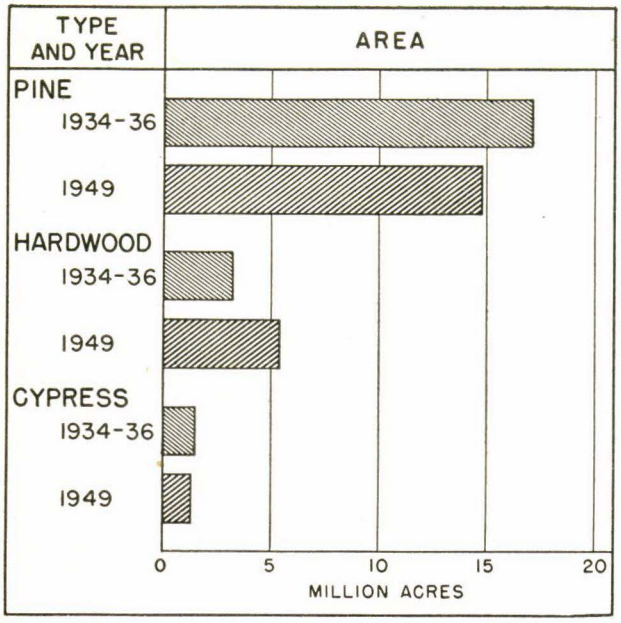

FIGURE 29.—*Area of major forest types, Florida, 1934-36 and 1949.*

coupled with a dense understory of scrub oak and other poor-quality hardwoods has prevented the regeneration of longleaf pine over a large area. Nearly half of the trees in the 2- and 4-inch diameter classes in the longleaf pine type are scrub oak and other cull hardwoods. Thus, cutting the merchantable pine leaves a residual stand of undesirable hardwoods and rather unfavorable conditions for the establishment of more pine (fig. 30). The scrub oak type has increased by 600,000 acres since the first survey, and the upland hardwood type by 400,000 acres. There appears to be little chance of many of these areas coming back to pine unless some of the hardwood cover at least is eliminated. Where a seed source is absent, which is true in many instances, planting will also be necessary.

The million-acre increase in the area of lowland hardwood types since the first survey is mainly the result of cutting the cypress and pine out of the mixed softwood-hardwood stands. The cypress type decreased by 200,000 acres and loblolly pine by 200,-

FIGURE 30.—*Cutting of the merchantable pine has converted a large area of Florida's longleaf pine to scrub oak and upland hardwood types.*

000 acres. As in the case of longleaf pine type on dry sites, the perpetuation of pine on many of these low, moist areas fringing the river bottoms is going to require the elimination of the understory of hardwoods during the period of stand regeneration. On the best of the sites, growing high-quality hardwoods, or a mixture of pine and hardwoods, rather than pure stands of pine, may prove to be the most profitable course to follow.

Large Number of Worked-Out Trees

In the 15 years since the first survey, commendable progress has been made in utilizing the 20 million worked-out naval stores trees that clogged the pine stands in the mid-thirties. The pulp industry, by creating a new market for millions of cords of wood that could be cut from worked-out timber, has been a significant factor in bringing this about.

By 1949, despite annual additions as naval stores crops were worked out, the total number of worked-out trees had been reduced to 7.8 million. Nearly 2 million of these were in Northwest Florida and about 700,000 were in the central part of the State. All together, they amounted to less than 4 percent of the total number of turpentine pines of saw-timber size and their presence does not materially reduce timber yields in these two areas.

In Northeast Florida there are about 5.2 million worked-out trees. Here, 6 percent of all longleaf and slash pine trees of saw-timber size are worked out, plus nearly a half million 7- and 8-inch trees. Cubic-foot growth on these trees is about a third less than on round trees, and mortality losses are high. They should be cut as promptly as possible, unless they are needed for seed, in order to make way for new growth.

Reasons Why Forest Conditions Are Poor

Fire—The Number One Problem

MANY of the undesirable forest conditions in Florida are the result of land-use practices—practices associated with farming, turpentining, and logging. Of these practices, frequent burning of the woods has most influenced the character of the forest.

Since the days of the early white settlers, woods burning has been practiced with a deep-seated conviction that it is as essential to the proper handling of wooded land as plowing is to growing cotton. In 1926, it was estimated that at least 75 percent of the pine land in the State burned over annually and that not more than 10 percent ever escaped fire for 3 years in succession *(1)*. Not until as recently as the mid-thirties was there any appreciable downward trend in the area burned by wildfires.

This long history of frequent burning of the stands had two main effects on the character of the forest. First, it served to extend the occurrence of the fire-resistant longleaf pine to the very edges of the swamps, bottom lands, and upland hardwood lands.

The second, and perhaps the more important, effect of repeated burning was that of keeping the stands open and understocked. Even though longleaf pine existed over a wide area only by virtue of repeated fires, these same fires took a heavy toll of young trees before they became large enough to survive the flames. This annual toll of young trees by fire, coupled with the uncertain seed-bearing habits of longleaf pine, made the restocking of the stands a very slow process. Even in many of the virgin stands, the trees were widely scattered. Full stocking in these stands frequently represented a gradual accumulation of trees over many years. There is little doubt that the too frequent fires down through the years have been responsible for a good deal of the poor stocking in Florida.

Fire protection on other than national-forest land had its beginning in Florida with the enactment, by the 1927 State Legislature, of a law creating a Board of Forestry. One of the provisions of this law authorized the Board to enter into cooperative agreements with landowners for the prevention and control of woods fires. The landowners paid for half the cost of prevention, and, in most instances, for the cost of fire suppression. Federal funds made available to the State under the provisions of the Clarke-McNary Law were used to offset private expenditures, while the State provided the funds for a skeleton organization to supervise the work *(5)*.

By 1935, the Board had succeeded in extending organized fire prevention and control to 1.4 million acres of private forest land *(6)*. However, real progress in reducing the area burned over annually by fire took place after 1935. The strengthening of fire laws and a basic set-up for county cooperation was followed by a steady increase in area under organized protection (fig. 31) and significant reductions in the total area of forest land burned over annually (fig. 32). As of July 1, 1950, more than 30 of the 67 counties were under organized fire protection (fig. 33). This area, together with national-forest land and protection units comprising parts of 19 other counties amounted to over 14 million acres, or two-thirds of the total forest area in the State.

Estimates of area burned over, of course, are necessarily rough—especially on unprotected area. However, the trend is unmistakable. During the 5-year period 1930–34, the average annual burn amounted to nearly three-fourths of the total forest area in the State. By 1946, the annual burn had dropped to less than a fifth of the total forest area. During 1950, 63 percent of the unprotected area and 3 percent of the protected area was burned over by wildfires, resulting in a total burn of about 4.8 million acres.

This reduction in wildfires accounts to a large extent for the significant increase in amount of young timber and the replacement of longleaf pine by slash pine over extensive areas of the better flatwood sites, which took place between the two forest surveys. The

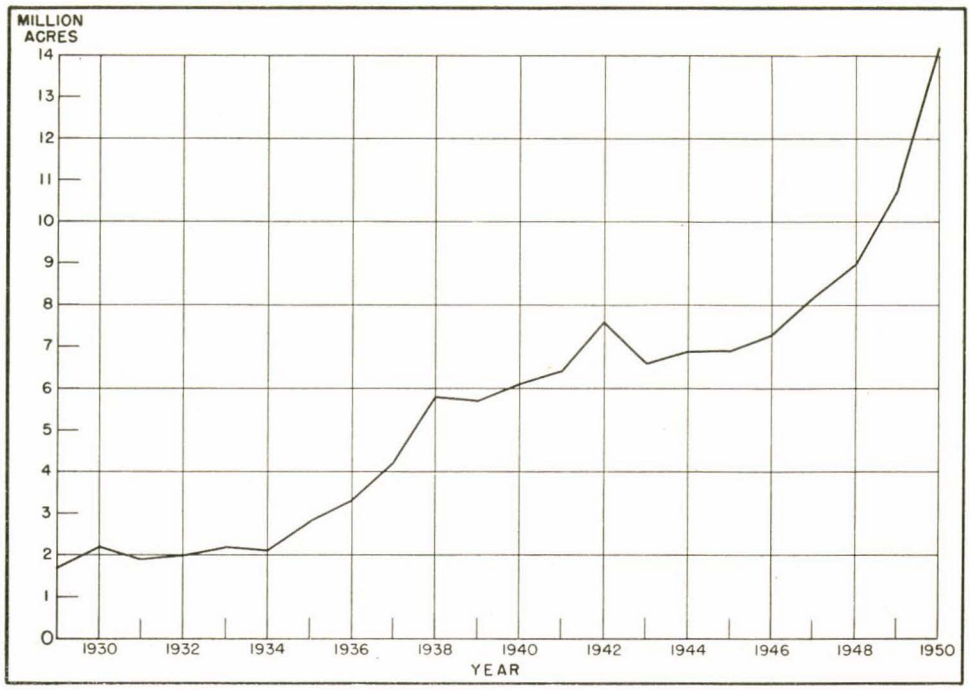

FIGURE 31.—*Forest area under organized fire protection in Florida, 1929 to July 1, 1950.*

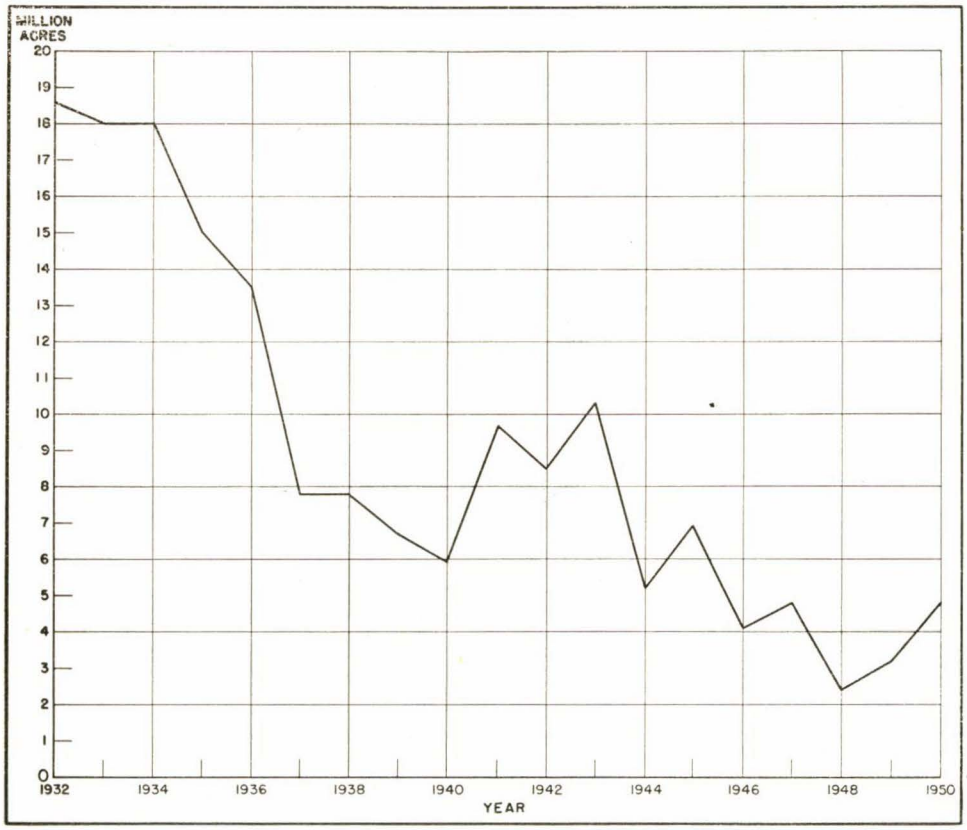

FIGURE 32.—*Forest area burned over annually on protected and unprotected land, Florida, 1932 to 1950.*

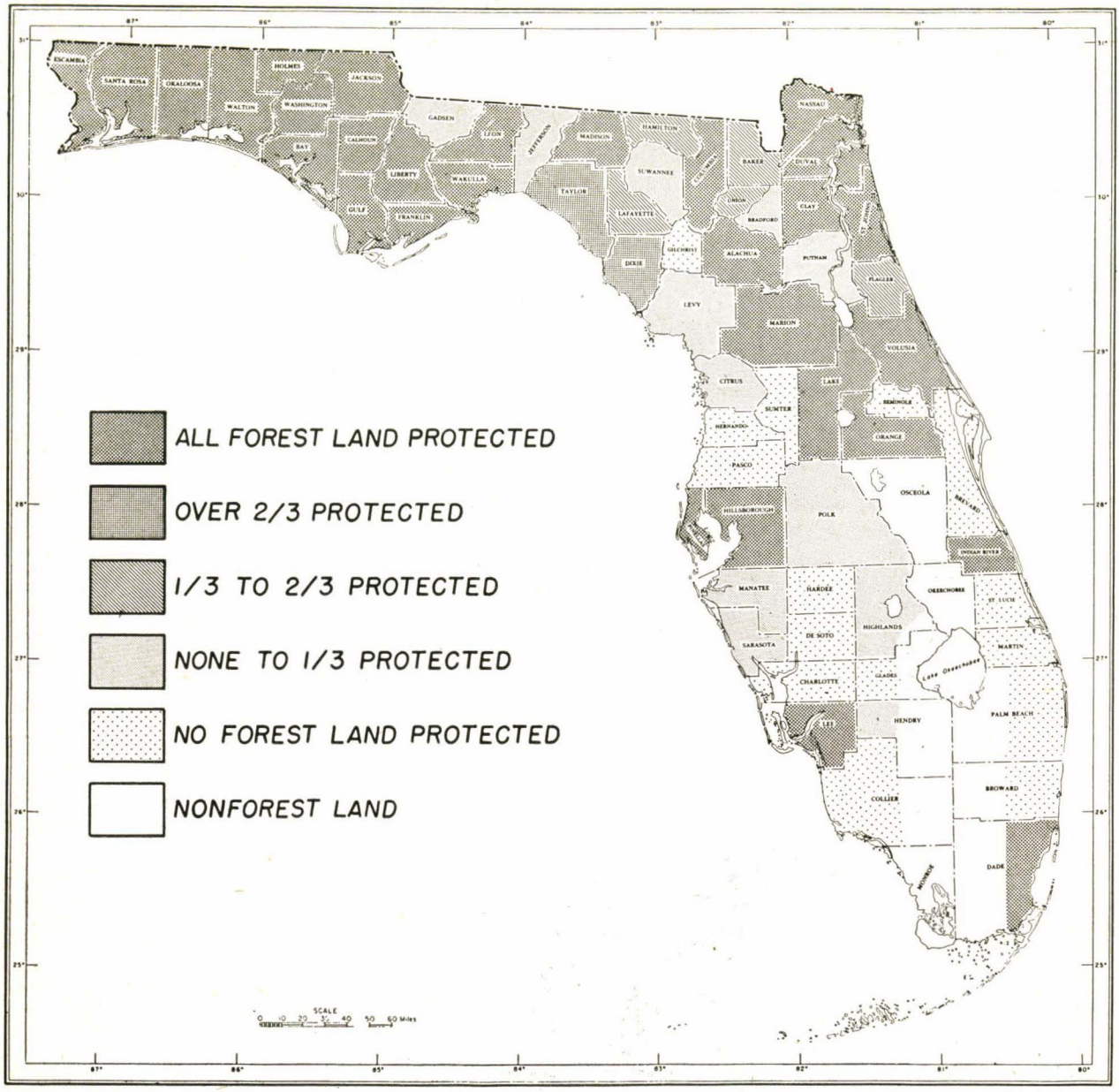

FIGURE 33.—*Florida counties with organized fire protection as of July 1, 1950.*

increasing backlog of young timber has resulted in the upward trend in growth, as every year more and more young trees grow into merchantable sizes, adding their volume to the growth. Also reflecting better fire protection is the reduction in mortality.

Improved fire protection, along with its beneficial effects, has also created some problems. Complete exclusion of fire on some areas has contributed to the 2.3-million-acre decrease in pine types by permitting dense understories of hardwoods to become established in pine stands, thus preventing pine regeneration. Also, in some areas, the extension of titi thickets from swamps and ponds to the flatwoods land has impeded the establishment of slash pine. Even where the accumulation of vegetative growth or "rough" did not seriously interfere with regeneration, a serious fire hazard was frequently created so that when fire did occur, it was especially destructive. In 1943, the Mount Carrie Fire on the Osceola National Forest on land which had been protected

from fire since the early thirties resulted in the complete destruction of even merchantable stands over a large part of the 9,000 acres burned.

For a long time, public fire protection agencies, drawing on experience in other sections of the country, have been reluctant to regard fire in the southern woods as anything but bad. However, recent experience and the results of carefully conducted studies have made it increasingly clear that fire, when properly used, can be a valuable tool in the management of many southern pine forests. Fire is effective in killing titi, gallberry, myrtle, and other commercially worthless species which encroach and occupy good pine sites in thickets so dense as to exclude pine reproduction *(10)*. Fire effectively controls brown spot disease which in some instances prevents the establishment of longleaf pine *(28)*. Where the rough is thick, seeds which germinate fail to reach mineral soil and die. Burning the rough prior to seedfall often results in excellent pine regeneration *(10)*.

These studies further show that slash pine stands will tolerate moderate burns after saplings reach a height of 12 to 15 feet *(18)*. Longleaf pine is a good deal more fire resistant. In the Coastal Plain, at least, there is little evidence that even repeated fires at frequent intervals cause site deterioration *(11)*. As a result of these studies, the techniques for the use of prescribed burning as a silvicultural tool in the longleaf-slash pine region have been worked out and published *(18)*, *(23)*, *(2)*.

These findings in no way minimize the urgent need to reduce the area burned over by wildfires. Every year wildfires take a heavy toll of timber, especially the seedlings and saplings which are so vital to the future supply (fig. 34). Also, there is a need to improve prescribed-burning practices. Areas are sometimes fired without adequate consideration of burning conditions and without taking the necessary steps to protect blocks of young growth within the burned area. Thus, in spite of the progress made in

FIGURE 34.—*The effect of fire on slash pine regeneration. The area on the right has been protected from fire, while the area on the left has been burned over annually since 1940. (Photo courtesy Florida Forest Service.)*

the past 15 years, woods fires are still Florida's number-one forest problem.

Grazing and Timber Growing

Cattle raising in Florida is rapidly growing in importance. Between 1940 and 1945, the number of cattle and calves increased from 721,000 to 1,115,000, a 55-percent increase *(24)*. The trend has continued upward since 1945. In 1948, the gross cash income of Florida farmers from cattle and calves amounted to 31 million dollars *(7)*, equal to more than half the value of sawlogs, poles, pulpwood, and other rough wood products harvested from the forests.

Cattle raising has an important bearing on forest conditions and the timber supply outlook. A great many of the cattle in Florida are scrub, or piney-woods cows, which generally depend entirely upon native grass on wild land (much of it forest land) for feed. The cattle themselves are seldom concentrated enough to do much damage to the young trees by trampling. The damage to the timber comes almost entirely from the age-old practice of annually burning the woods to improve the cattle range. The owners of the cattle frequently own very little land themselves, and run their cattle on other people's land. Thus, a great deal of the burning is done by people who are not interested in timber values.

As has been pointed out, both timber growing and cattle raising are important sources of income in Florida. The question arises: To what extent is the sacrifice of timber values justified, or necessary, in improving cattle range? To fully answer this question, more information concerning the management of forest range and its relation to timber production is needed, including the income that might be expected from alternative or integrated uses of various types of land. However, information now available indicates that Florida's forest land could be made to produce more of both timber and beef, and that the conflict between timber growing and grazing is not as great as it seems to be *(18)*. Further, methods of harmonizing timber and cattle production will vary considerably according to the relative importance of the two industries, which varies markedly in different parts of the State.

In the northern part, timber production greatly overshadows cattle raising as a source of income from forest land. Yet many cattle are raised there; according to the Bureau of the Census, 40 percent of all the cattle and calves on farms in the State in 1945 were in Northeast and Northwest Florida (fig. 35). A large part of these were scrub cattle, which depend entirely on native range for feed.

Experience on the Olustee Experimental Forest in northeastern Florida indicates that with only native range and piney-woods cows the timberland manager is seldom justified in sacrificing timber values to benefit the cattle *(18)*. The damage to timber values caused by annual burning to improve the cattle range is usually far in excess of the returns from the cattle. However, under proper management some cattle can be grazed on forest land without interfering with timber production (fig. 36).

This means adjusting cattle stocking to the carrying capacity of an annual burn of 10 to 15 percent of the area instead of the 30- to 50-percent usually preferred by operators who use prescribed burning primarily to obtain better forage to increase cattle gains *(18)*, *(3)*. With burning keyed in this way to the needs of the timber and without the use of improved pasture, it is estimated that 50 acres of flatwoods forest land will provide enough feed for one cow grazing throughout the year. The returns from such yearlong grazing would not be high but they would materially help in meeting the expense of taxes on the land. Also, grazing is beneficial in reducing the fire hazard by retarding the build-up of flammable undergrowth, such as gallberry and palmetto *(3)*.

Herd management studies on native forest range at the Georgia Coastal Plain Experiment Station have shown the advantage of seasonal grazing and supplemental feeding on the range when the nutritive value of native forage is deficient *(8)*. This permits growing a better grade of cattle and results in a greater annual crop of larger calves.

In Central and South Florida, the timber-growing possibilities on much of the forest land are open to question. In contrast to conditions in the northern part of the State, concessions to timber values at the expense of the production of grass may not be justified on certain areas. However, this question has never been studied adequately. Here is a real need for research on both the technical and financial aspects of land use in Central and South Florida.

Many people feel that much more timber could be raised along with cattle in the southern part of the State, and a greater total income produced from

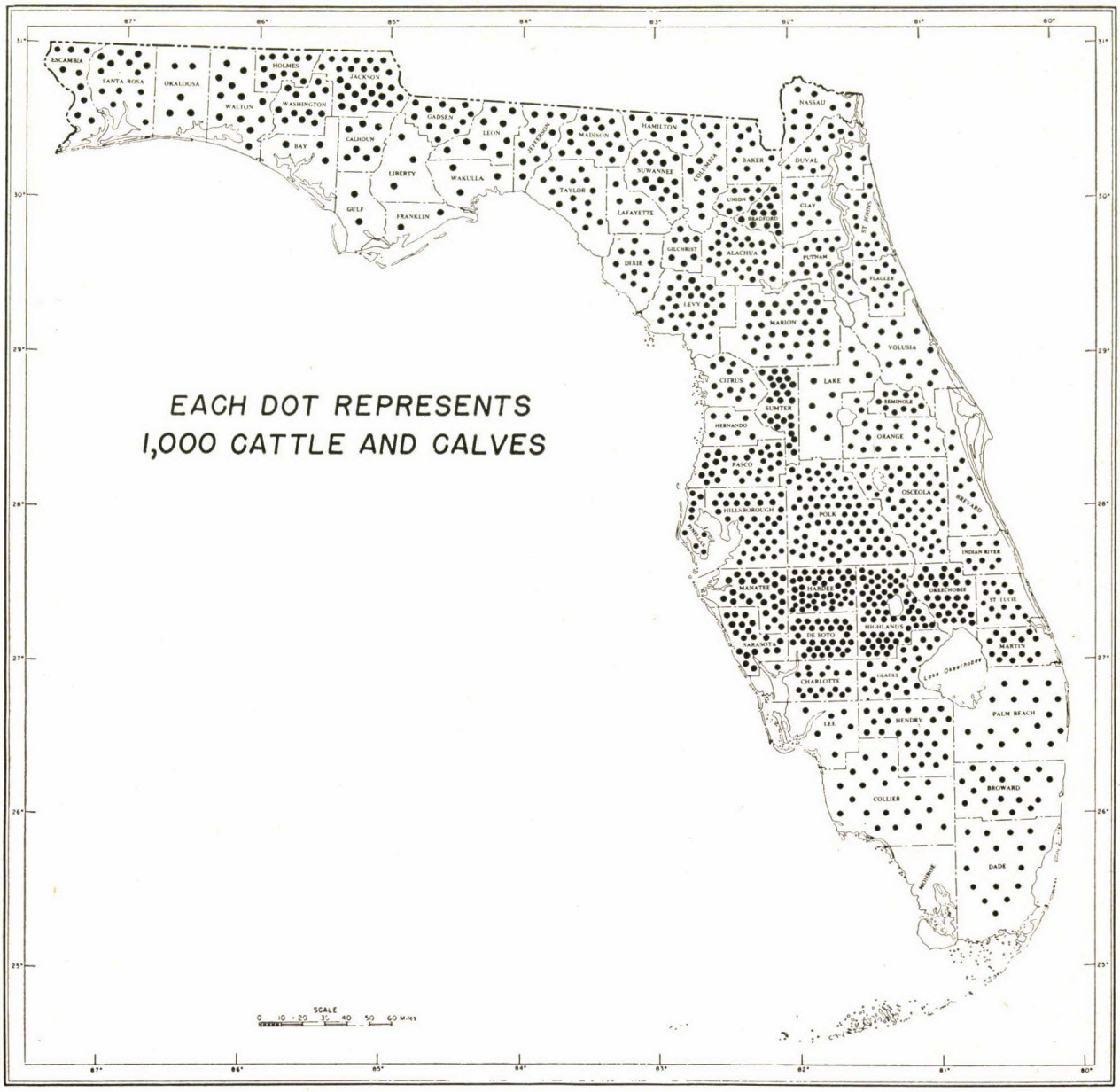

FIGURE 35.—*Distribution of cattle and calves on Florida farms, 1945.*

the land. The common practice is to run cattle entirely on natural range or unimproved pasture. The land is poorly stocked with trees, and at the same time produces such poor forage, that the landowners can raise only scrub cattle. Returns from both timber and cattle are very low. An increasing number of landowners are finding it more profitable to convert part of the land into improved pasture and use the remaining wild land as a supplemental or seasonal source of feed. This not only greatly increases the carrying capacity of the land, but permits the landowner to raise improved breeds of cattle. At the present time, little consideration is given to the timber-growing possibilities on the remaining unimproved land. However, it seems probable that by keeping fire out of selected blocks long enough to permit forest regeneration, a crop of trees could be grown without greatly reducing the value of the land as a source of supplemental feed. In some instances, planting might be justified.

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FIGURE 36.—*Although timber is by far the most important source of income from forest land in the northern part of the State, it is possible under proper management to raise some cattle without interfering with timber production.*

Gum Production and Timber Yields

Some practices associated with gum production, which is confined to slash and longleaf pine, contribute to undesirable forest conditions. In the past, it was the custom to rake the debris away from working trees to protect them from frequent wildfires. The fires, on the other hand, served to keep the woods free of undergrowth and to make it easier for the turpentine workers to move about in the stands. However, this frequent burning took a heavy toll of young trees and helped to keep the stands open and poorly stocked. Often little effort was made to confine these fires to any particular area; they frequently escaped to adjoining areas to add to the annual damage caused by other wildfires.

Gum production conflicted with timber production in other ways. The practice of hanging cups on all trees in the stand above a certain diameter is the principal reason for the present serious shortage of large timber. Prior to the establishment of the Naval Stores Conservation Program in 1936, it was common practice to chip all trees in the stand 8 to 9 inches and larger. Some 7-inch trees, and occasionally trees as small as 6 inches were cupped. Chipping affects a tree in several ways. First of all, it reduces growth; according to studies of wood-chipping methods, diameter growth may be reduced by a third to a half. Even after chipping stops, especially if chipping is deep, trees often do not recover normal growth *(18)*. However, recent studies show that bark chipping has very little effect on growth.

A second effect of chipping these small trees was to reduce their quality for wood products. Many a potential pole or saw-timber tree is suitable only for pulpwood by the time it is worked out.

Mortality among small turpentined trees was particularly high. Chipping, burning of the faces by wildfires, and subsequent borer attacks so weakened the trees that large numbers were broken down by the wind every year. These were usually left lying on the ground and were eventually burned up in subsequent fires.

Thus, since most of the young-growth timber was worked for gum as soon as it became large enough, very few small trees had the chance to grow into quality saw timber. This absence of young timber to replenish the supply of saw timber accelerated the already rapid decline caused by heavy cutting.

FIGURE 37.—*The practice of selective cupping leaves part of the trees in the stand unworked to grow and become more valuable for both naval stores and timber products. (Photo courtesy Florida Forest Service.)*

Gum production does not conflict with timber production nearly as much now as it did in the past. One reason is that a much smaller proportion of the timber is being worked for naval stores. Also, more and more operators are adopting improved practices.

The raising of the minimum diameter of trees worked represented an especially significant improvement in turpentining practices. Before 1936, in most sections, about one-third of all the trees cupped were less than 9 inches in diameter. Now, largely because of the Naval Stores Conservation Program, practically no trees smaller than 9 inches are cupped *(20)*. This has contributed to a marked reduction in the number of small trees which die or blow over every year.

The rise of the pulp and paper industry has also been an important factor in reducing timber mortality resulting from turpentining. Worked-out trees which were too small or too low in quality to make sawlogs were once left in the woods to die or blow over; now they are cut for pulpwood.

One of the main reasons for the significant increase in young timber and the accompanying increase in net growth since the first forest survey has been this reduction in the loss of timber in stands worked for naval stores. As pointed out previously, pine mortality in 1948 was only 14 percent of what it was in 1934–36.

An increasing number of operators are improving the quality of their worked-out timber, without reducing their returns from gum production, by bark chipping and using acid to stimulate the gum flow. On the Olustee Experimental Forest, trees that had been chipped and treated with sulfuric acid every 2 weeks during the naval stores season for a period of 5 years were practically equal in quality to round trees *(9)*. Contrary to the prevalent practice of cutting off the worked portion of the tree, the faces were left on the logs. Both the bark-chipped face and the pitch soaking beneath the faces were entirely removed in normal slabbing of the logs and

edging of the lumber. The lumber from behind the face was in no way affected by the presence of the face.

Progress in getting general adoption of the bark-chipping and acid method has been reasonably good considering that the gum naval stores industry is not susceptible to rapid change in operating methods. The techniques for this method were worked out in 1944, but satisfactory equipment for the application of acid was not available until several years later. In 1950, a fourth of the gum naval stores producers were using acid to stimulate gum flow.

Another practice which improves the value of the worked-out trees for wood products is hanging the cups in such a way as to permit removing all the nails and metal from the trees when turpentining has been completed. Because of the damage to saws, stumpage prices for timber with nails in it are considerably less than for nail-free timber.

Selective cupping is another practice which serves to reduce the conflict between gum and timber production (fig. 37). Instead of working all trees above a certain diameter, only those trees which should be removed from the stand to improve its quality and growth are worked. Leaving the best trees to grow means not only greater gum yields in the future but also more and better quality timber. Turpentining only those trees that are scheduled for early removal has another advantage. It avoids excessively long turpentining periods that characterized older methods. The fresh faces resulting from shorter periods of turpentining have much less timber defect than older faces, which usually get burned and become wormy and pitch-soaked.

Research findings in recent years have made available to landowners practical improvements of demonstrated value for increased gum production and for the integration of gum and timber production to obtain the maximum value from both. In spite of the fact that this information is available in clear "how-to-do-it" style, there still remains a big job in getting general adoption of improved practices.

Cutting Practices and Forest Conditions

Poor methods of timber harvesting are contributing to poor stand conditions. Although an increasing number of landowners and forest industries are improving their cutting methods, it still is a common practice in Florida to clear-cut all the timber large enough to make pulpwood (fig. 38). The effect of this type of cutting varies depending upon the character of the stand and quality of forest land. Even when all of the merchantable timber is removed, a scattered residual stand of spindly and defective trees is often left. Many of these recover and in time grow large enough to bear seed. With protection from wildfires, the better sites restock quite readily. But this is a slow process which greatly increases the time required to grow another crop of timber. Further, foresters fear that these residuals left to restock the land are sometimes inherently slow-growing and poor in quality. There is the danger, then, that this practice will result in a steady degradation of the quality and growth characteristics of the timber in subsequent generations.

Unfortunately, these heavily cut areas are often subjected to repeated burning. Not only are the seedlings which get started repeatedly killed, but the number of seed trees and potential seed trees is steadily reduced. In spite of the readiness with which the good sites regenerate naturally, in 1949 nearly a half million acres of good-quality pine land (site index 70 or better) were so completely denuded that planting will be required to bring them back into forest production in a reasonable length of time.

On poor sites, heavy cutting is an even more serious threat to stand productivity. At best, regeneration is slow and uncertain, particularly in the case of longleaf pine. The delay in restocking caused by cutting all of the seed-bearing trees permits the establishment of a heavy cover of scrub oak and other undesirable shrubs and hardwoods over extensive areas of dry, sandy ridge sites. Largely because of the presence of scrub oak on such sites in 1949, 2.8 million acres of poorly stocked longleaf pine type and nearly 2 million acres of scrub oak type were not expected to restock naturally with commercial species. Since the first survey, the scrub oak type has increased by 600,000 acres.

A great deal of the heavy cutting in Florida is associated with the practice of diameter-limit cupping for gum production. Because many of the stands are even-aged, cutting the worked-out trees frequently leaves the area virtually denuded of timber. Raising the minimum diameter of working trees from 7 to 9 inches and reducing the number of trees being worked has resulted in an increase in the number of round trees in worked-out stands, but it still is possible to find instances where small round trees have been cut along with the worked-out timber.

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FIGURE 38.—*Cutting which leaves the land without an adequate seed source is still a common practice in Florida.*

Some clear cutting is done in connection with preparing the land for improved pasture, citrus orchards, and other farm crops. While land clearing for agriculture is active in certain areas, notably in Central Florida, for the State as a whole the amount of clear-cut land which is actually converted to agricultural use is rather small.

Poor cutting practices not only contribute to poor stocking, but species composition and stand quality are likewise affected. Heavy cutting of the pine has converted many mixed pine-hardwood stands to pure hardwood types, and, in part, accounts for the million-acre increase in lowland hardwood types between the two forest surveys. Cutting of the most valuable species and highest quality trees has left hardwood stands with an extremely high proportion of poor-quality trees. These not only take up growing space and interfere with the development of the more valuable young growth, but they frequently grow very rapidly following cutting and add to the volume of cull trees. Also, many of the trees left are of such poor quality that they soon become culls. The large increase in both the proportion and quantity of cull hardwood timber in Florida since the first forest survey is, for the most part, the result of this practice of "high-grading" the stands.

Land Ownership and Forest Practices

Land-use practices affecting forest conditions vary widely, depending upon who owns the land. Many of the undesirable practices contributing to poor forest conditions arise from the fact that a great deal of the forest land is owned by people who have little or no interest in growing timber. A large proportion of the timber cut comes from this class of ownership. In 1945, 87 percent of the privately owned forest land in Florida was owned by people who were not associated with the wood-

using industry. Farmers own about a fifth of this area; the remaining area is owned by people engaged in a wide variety of occupations.

Among the private owners are naval stores and railroad operators, bankers, doctors, and local merchants. Some of these owners, of course, do recognize timber values, and make an effort to manage their land to realize these values. However, the primary interest of most of these owners is not timber growing. They either are not aware of the potential returns from timber on their forest land or they are so absorbed in other occupations that they give little attention to timber growing. This lack of interest in managing their land for timber crops is reflected by the kind of cutting being done on these ownerships. In 1945, two-thirds of the cutting on private ownerships, exclusive of lumber and pulp companies, was rated poor or destructive.

In contrast, all of the cutting on pulp company land was rated fair or better.[7] Although cutting practices on land owned by lumber companies was not so good as that on pulp company land, it was still substantially better than the cutting on ownerships not associated with the wood-using industry. About half of the cutting on lumber-company land was rated poor; very little of it was rated destructive.

Forest land in public ownership amounts to about 2.3 million acres, or about 10 percent of the total area. Two million acres of this is in Federal ownership including the national forests, and 223,300 acres is owned by the State. The remainder is in county and municipal ownership. In 1945, two-thirds of the cutting on publicly owned land rated fair or better; most of the remainder was poor.

Land ownership affects not only cutting practices but also other practices that have a bearing on timber production. While other uses are permitted on forest land owned by public agencies and forest industries, they are usually fitted into timber-production plans. An effort is made to prevent wildfires. Grazing is usually controlled. Some companies have bought cattle to run on their own land in order to better control the burning done by others in connection with cattle raising. Others permit grazing only under provisions which stipulate the location and size of the area that can be burned annually to improve the range.

Naval stores practices on these ownerships usually are not allowed to interfere with timber values. Only selective cupping is permitted on national forests. Some forest industries refuse to allow any turpentining of their timber because of the difficulty of insuring practices that will not damage the timber values.

Forest industries and public agencies own but a fifth of the forest land, yet during the 1949-50 tree-planting season they planted 59 percent of the total area planted in Florida. The proportion of forest land in this class of ownership has increased since 1945. Pulp and paper companies in particular have added large acreages to their holdings.

It appears likely that with the increased awareness of timber values, many private owners not associated with forest industries have improved their forest practices since 1945. However, there still remains the difficult task of getting many thousands of small owners with a wide variety of interests to recognize the potential returns from their timberlands and to adjust their management practices accordingly.

[7] Good cutting requires good silviculture that leaves the land occupied by desirable species in condition for vigorous growth in the immediate future. Fair cutting marks the beginning of cutting practices which will maintain on the land a reasonable stock of growing timber in species that are desirable and merchantable. Poor cutting leaves the land with limited means for natural reproduction, often in the form of poor-quality trees of undesirable species. Destructive cutting leaves the land without timber values and without means for natural reproduction.

What Needs to be Done

IN BRIEF, the findings of the 1949 forest survey reveal that, although the timber supply outlook in Florida has improved in many ways since the first forest survey, some of these gains have been offset by further deterioration in other ways. The principal gain was the increase in growth brought about by a substantial increase in the amount of young timber, coupled with a marked reduction in mortality. As a result of this increased growth, along with a reduction in commodity drain, during the year 1948 both saw-timber and all growing-stock growth exceeded drain for the State as a whole.

However, in spite of these encouraging improvements, many undesirable forest conditions that existed at the time of the first forest survey have become worse. Florida now has less area of pine types and more area of scrub oak, more area of poor quality hardwood type, more volume of cull hardwoods, and smaller volume of large, quality timber. There is still far too much poorly stocked land, and in some areas too many worked-out turpentine trees in the stands.

These undesirable conditions are not entirely the result of past practices; many of the factors giving rise to these conditions are still active. In spite of the improvement in forest practices since the first survey, indiscriminate and careless burning of the woods for range improvement and other reasons, poor naval stores practices, and poor cutting practices are still prevalent enough in Florida to cause further serious deterioration. A continuation of these practices not only threatens to nullify past gains but to retard the build-up in forest productivity.

To meet its own need for wood products and also to contribute its share of timber to the national goal,[8] it is estimated that Florida should plan to grow twice as much saw timber and three-fourths again as much timber 5.0 inches and larger as it did in 1948. This would mean increasing saw-timber growth from a little more than a billion board feet to more than 2 billion, and growing-stock growth from 370 million cubic feet to nearly 650 million.

Before any substantial progress can be made toward the achievement of this goal, corrective action along several lines must be stepped up.

1. *Reduce the loss of timber due to fire.* The first and most important step toward reducing fire damage is the extension of organized fire protection to all forest land in the State. But the job of reducing fire losses does not stop with organized fire protection; in many cases it will have to be followed by intensive effort to get better enforcement of fire laws, and by education aimed at making local people aware of the harm done by indiscriminate burning. Even when landowners realize that they should protect their land from wildfires, they frequently need information and technical advice on how to use fire safely and effectively (fig. 39). Still more research on the techniques of prescribed burning and their relation to timber management, turpentining, and grazing is needed.

2. *Integrate timber growing and grazing.* A good deal, perhaps most, of the damage to timber values caused by fire would be eliminated if burning in connection with cattle raising could be controlled. The landowners themselves, especially those in the northern part of the State, are becoming increasingly aware of timber values and are becoming more and more interested in controlling the burning on their land. The big job is that of restraining the people who run their cattle on other people's land and have no stake in the timber. The recently adopted fence law in Florida, which requires that stock be kept off State highways, promises to be an important step in this direction. The law will require fencing range land adjacent to State highways. Landowners can then control grazing by refusing to permit the building of a fence on their land or by making the

[8] National goal for annual growth placed at 20 billion cubic feet of all timber, including 72 billion board feet of saw timber, by Forest Service reappraisal of the forest situation in 1945.

FIGURE 39.—*Where fire is needed to keep down the "rough" or to encourage cattle feed, it should be done according to prescribed burning practices. (Photo courtesy of Florida Forest Service.)*

building of fence contingent upon abiding by certain restrictions in the use of fire. Further, cattle owners will often be discouraged from running their cattle on other people's land when faced with the expense of building a fence.

What is also needed to resolve this apparent conflict between cattle raising and timber growing is a better knowledge of the technical and financial aspects of the two uses on various types of land throughout the State. Studies are needed to determine the proper balance between timber and cattle production—the balance that will result in realizing the maximum income from the land. The results of such studies would enable landowners and protection agencies to gear their protection efforts to the timber values involved.

3. *Integrate naval stores production with timber growing.* Improved methods of naval stores production have been pretty well worked out. As pointed out in an earlier section, studies show that by using these improved methods it is possible to integrate gum production with timber growing without significantly reducing the growth or value of the timber for forest products. The job ahead is mainly one of getting these practices generally adopted. This calls for distributing information to landowners, conducting demonstrations, and making available technical advice and aid.

4. *Improve forest cutting practices.* A continuation of present cutting practices threatens to nullify a good deal of the effort to improve forest conditions along other lines. Steps should be taken to encourage commercial forest landowners to leave an adequate number of seed trees of desirable species and form following cutting. Also, partial cuttings aimed at increasing the growth and quality of the stand should be encouraged.

5. *Step up the planting program.* All together, Florida has 7.1 million acres of forest land which, because of inadequate seed source, are not expected to restock. About a half million acres of this is rated good-quality forest land, about a million acres is fair, and the remainder poor-quality land.

In general, most of the planting effort should be directed toward restocking the more productive land first. However, there are landowners who have little else other than poor-quality forest land. Even though the returns from their investment in planting may be low, these owners still may wish to restock their land rather than let it lie idle.

During the 1949-50 planting season, a total of 43,000 acres was planted in Florida. At this rate, it would take 35 years to plant just the 1.5 million acres of fair- and good-quality nonrestocking forest land. To do the job in 20 years would mean stepping up the annual planting to 75,000 acres, or nearly double the area planted during the 1949-50 season.

A large part of this 1.5 million acres of nonrestocking fair- and good-quality forest land is suitable for machine planting (fig. 40). About 1.3 million acres is made up of areas that are at least 10 acres in size and sufficiently firm, level, and free of stumps and rocks or scrub timber to permit the operation of a tractor-drawn planting machine. The remaining area would have to be planted by hand.

6. *Work out ways of restocking the less productive forest land.* One reason for concentrating the planting effort on the more productive land is that methods of getting the poorer land restocked have not been very well worked out. All together, Florida has 5.6 million acres of poor-quality land which is

FIGURE 40.—*Florida has 1.5 million acres of fair- and good-quality nonrestocking forest land. About 1.3 million acres of this is suitable for machine planting. (Photo courtesy of Florida Forest Service.)*

unlikely to restock naturally for many years. Of this, 2.1 million acres is longleaf pine type and 1.7 million acres is scrub oak type. Originally, most of this area was covered with merchantable stands of longleaf pine.

For the most part, slash and loblolly pine, the species usually recommended for planting, do not thrive on these dry, sandy ridge soils. Although longleaf pine is the species best adapted to this type of land, attempts to get it established have not been successful. Most of these areas, however, are capable of growing fair stands of longleaf pine. The problem is to find an effective way of getting them established again following the removal of the merchantable stand. A stepped-up program of research on both the basic and applied aspects of natural and artificial regeneration of longleaf pine on the poorer sites is needed.

Florida also has 1.5 million acres of poor-quality slash pine land which is not restocking. Nearly a million acres of this nonrestocking poor-quality slash pine land is in South Florida. This part of the State needs more forest industries; it has the potential timber-growing capacity to support more. But until large parts of this nonrestocking land can be brought back into forest production, opportunities for expansion in this region are very limited. There is evidence that fire protection coupled with simple management practices would make reforestation in the southern part of the State a financially attractive venture. A growth study in Lee County showed that where fire was excluded or very rare, diameter growth was more than double that on areas burned annually or frequently. However, a thorough investigation of both the technical and financial aspects of reforestation and timber management in this part of the State is needed.

7. *Make better use of available timber.* Shifts in the kind of timber used for various products would help to prevent further deterioration of forest conditions. There is a need to ease the commodity-drain pressure on the rapidly disappearing supply of large timber which is the base for the maintenance and future expansion of the lumber industry. One way to do this is to reduce the amount of pulpwood cut from large timber. In 1948, 29 percent of the pulpwood was cut from trees 13.0 inches and larger. A shift of the cut to smaller sizes would seem to be feasible in view of the rapidly increasing supply of small timber. Another saving could be made by increasing the amount of pulpwood taken from tops of pine trees cut for sawlogs. In 1948, the tops of pine trees cut for sawlogs amounted to about 233,000 cords. Of this, 187,000 cords were used for pulpwood. About 15 percent of the total pulpwood cut came from tops in 1948; with better coordination between sawlog and pulpwood operations, it should be possible to increase this proportion to 20 percent.

Also, a greater amount of pulpwood could come from thinnings. In 1949, 860,000 acres of pine stands were overstocked. While most of the excess stocking was made up of trees too small to make pulpwood, these overstocked stands contained about 1.6 million cords of trees 5.0 inches and larger in excess of what is required to fully stock them. A significant increase in the amount of timber available from thinnings can be expected when the large backlog of young timber in these overstocked stands reaches commercial size.

In 1949, there were 7.8 million worked-out trees in the State. A heavier cut of these low-quality trees would leave more round trees to grow into quality saw timber. The possibility of easing the commodity-drain pressure on the timber supply by utilizing sawmill wastes for pulp also should be investigated.

8. *Guide the development of forest industries.* The establishment of new industries that would compete with existing industries for timber already in short supply should be discouraged. Temporarily at least, Florida has little room for new sawmills. There is probably room for a moderate expansion of the pulp and paper industry providing the cut from thinnings, tops, worked-out timber, and low-grade hardwoods is stepped up. However, it would be desirable to keep the commodity drain at about the current level for a while to permit a substantial part of the young timber to grow into quality saw timber to build up the badly depleted supply.

Florida has a large amount of low-grade hardwoods which is not being used. There are more than a billion and a half board feet of low-grade hardwood timber (Grade 3B logs) and 22.7 millions cords of sound cull hardwood trees. Here is an opportunity for the establishment of new industries able to use this raw material in the manufacture of such products as fibre, alcohol, or molasses. Information on the location, amount, and quality of this type of timber should be made available to prospective new industries.

In spite of the adequate supply of round trees, an

expansion of the naval stores industries under existing practices would be very undesirable. This would serve only to convert a larger proportion of potential quality saw timber into low-grade, worked-out timber. There is already too much of the latter type of timber in the State. An expansion in naval stores operations under improved practices, however, such as selective cupping and bark chipping, is desirable and should be encouraged.

Although present opportunities for the establishment of more forest industries in Florida are limited, the future holds promise of substantial expansion, once growth can be brought more nearly in line with the potential capacity of the forest land. When this future expansion can take place depends upon how rapidly the corrective measures suggested are put into practice.

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Appendix

Survey Methods

The forest survey of Florida used aerial photographs as a basis for preliminary estimates of forest area and stand-class area. A stratified sample of forest plots was located on the photographs and was then carefully cruised on the ground. The county was the basic work unit. Detailed statistics by survey units and counties have been issued in five publications *(13, 14, 15, 16, 17)*.

Area Estimates

Acreages of forest and other land were estimated with the use of a dot grid placed on every third contact print along each flight line in each county. (In parts of South Florida suitable photography was not available so the dot grid was used on Soil Conservation Service maps made up from small-scale aerial photographs. In Taylor County lack of both photographs and Soil Conservation Service maps necessitated the use of a Florida Forest Service type map.) The proportion of dots falling on forest land when applied to the gross area of the county, as reported in 1940 by the Bureau of the Census, yielded a preliminary estimate of the acreage of forest and other land-use classes in each county. This estimate was revised after field checks were made of a sample of both forest and nonforest ground plots. All together approximately 148,000 of these dots were classified.

Every third dot classified as forest in the preceding step, about 27,500, was further classified into forest type, stand class, and density class by careful stereoscopic analysis of a one-acre plot surrounding the dot on the photograph. The proportion of plots falling in each classification when applied to the forest area of the county gave the total area in each classification. These totals were revised after a sample of plots was checked for proper classification on the ground.

In estimating the areas of various categories of land, there were two possible sources of error: (1) errors in classifying the dots and plots or in compiling the data, and (2) sampling errors. In this survey every effort was made to maintain a high order of accuracy in the collection and compilation. Frequent checks were made and a continuous program of training was carried out. The sampling intensity was sufficient to provide an estimate of the forest acreage of the State with a standard error of ± 0.4 percent. This indicates the probabilities are two out of three that the actual forest area is within ± 0.4 percent of the value given, exclusive of measurement and computing errors.

Volume Estimates

Timber cruisers made a detailed on-the-ground tally of photo plots in each stand-size class to obtain volume, growth, cull, and mortality data and to check the accuracy of the photo classification. The number of plots tallied varied according to the stand-size classe; i.e., every 3d large saw-timber photo plot, every 4th small saw-timber, every 6th pole-timber, every 13th seedling and sapling plot, and every 26th poorly stocked or nonstocked plot was taken. The total amounted to 3,542 one-fourth acre plots, although these were classified by forest type and stand-size class on a one-acre basis. An additional sample of 916 plots, classified as agricultural on the photographs or maps, was taken to provide a check on land-use changes since the date of photography.

In estimating timber volumes, the sources of error include (1) errors in classifying field plots and in compiling the data, (2) sampling errors, (3) inaccurate measurements of tree diameter, height, form, and cull, and (4) errors resulting from improper construction or use of tree volume tables. As in the case of area determinations, every effort was made to obtain accurate classifications, measurements, and final statistics through frequent checks and training. The volume tables used also were checked and found to give reasonably accurate results. The standard error of estimate of the board-

foot volume of saw timber in the State is ±1.7 percent; a corresponding error for the total volume in cords was not computed, but it should be smaller.

Growth Estimates

Net growth was computed only on live saw-timber and pole-timber trees. Cull trees and hardwood limbs were not included in growth calculations.

Measurements for growth calculations were obtained from increment borings taken from mechanically selected trees on the sample plots measured for volume estimates. A total of 5,242 sample trees 3.0 inches and larger in diameter were bored. In general, computational procedures consisted of adding the volume of small trees that grew to merchantable size or grew into a higher diameter-class group during the preceding 10-year period to the growth of the trees that remained in a particular diameter class.

Sample tree diameters were increased by using the measured diameter growth of trees of the same diameter class. For instance, the average diameter growth of 8-inch trees was based on the growth of trees that were 8 inches in diameter at the start of the growth period, not on the last 10 years' growth of an 8-inch tree. Also, an allowance was made for bark growth during this period. The projected volume of the sample tree was then expressed as an annual percentage increase through the use of compound interest tables, and these percentages were applied directly to the growing-stock volume. Mortality was obtained by special studies on the ground plots, and the total annual loss was deducted from total growth.

Growth of turpentined trees was determined by a special field study involving ring counts and radial growth measurements on stump and stem cross-sections of worked-out trees cut on logging and pulpwood operations.

Drain Estimates

Following the completion of the forest inventory of Florida in 1949, the Southeastern Forest Experiment Station and the Florida Forest Service cooperated in a field survey to determine the volume of raw forest products used in Florida or shipped to out-of-State users in 1948. A complete canvass of sawmills and primary nonlumber plants in Florida and adjoining areas was made to obtain 1948 production of logs, bolts, and stumps. Contacts with treating plants, railroads, large utilities, and exporters were made for data on hewn cross ties, poles, and piling.

The 1948 production of fuel wood, fence posts, and farm timbers was estimated through an area sample. Small areas totaling approximately one percent of the area of the State were selected mechanically from the Master Sample of Agriculture, a sampling system used by the Bureau of Agricultural Economics in agricultural sampling work. A complete canvass of each area was made to determine the amount of the items produced during 1948. The data were then expanded to give county and State totals *(4)*.

Additional information was needed to convert the 1948 production data to commodity drain. To obtain this, a separate study was made on a random selection of the woods operations for each of the 10 leading products. The study was made on active operations in order to determine: (1) the extent of overutilization or waste, compared to Forest Survey standards, in trees cut for the various products; (2) the species, tree sizes, log diameters, and quality of material used; (3) the species, size, and quality of trees ruined in cutting and logging operations; and (4) other information, such as bark thicknesses and length of bolts, for use in converting the information to the different units of measure.

Reliability of the Data.—Four general sources of error could affect the accuracy of the data used in the production and commodity drain estimates. These are reporting errors, canvassing errors, errors in compiling data, and sampling errors.

Most producers of fuel wood, fence posts, and farm timbers, as well as some small sawmills and other manufacturers, furnished estimates of production rather than actual bookkeeping records. Individual errors caused by this are not likely to be large and may tend to be compensating; but it is not possible to measure them. Enumerating work was done by men familiar with the locality who had been especially trained to do accurate canvassing work. All records and computations were carefully checked to eliminate possible error.

Sampling errors (standard errors of estimates) are the only errors that can be evaluated. They are measures of the reliability of the estimates based on the size of the sample and individual variations within it.

The sampling error for the total cubic-foot commodity drain estimate was ±1.8 percent, as shown by the following tabulation:

Product:	*Error of cubic-foot estimates (percent)*
Sawlogs	2.5
Pulpwood	2.5
Veneer	5.3
Poles and piling	6.3
Hewn cross ties	16.4
Fuel wood	6.1
Other	4.4
All products	1.8

This indicates the chances are two out of three that the actual commodity drain was within 1.8 percent of the estimated. Sampling errors shown apply only to State totals. As the totals are broken down by counties and species groups, their reliability diminishes.

The sampling error was computed only for cubic-foot commodity drain. However, the reliability would be slightly higher for board-foot commodity drain and approximately the same for standard-cord commodity drain.

The sampling error in the production estimate would be very low, since a complete canvass was made except in the case of fuel wood, fence posts, and farm timbers. Computation of the production estimate was mainly a matter of combining individual reports to obtain county and State totals.

Public Land Ownership

Information on the forest area and timber volume in Federal, State, county, and municipal ownership was obtained in the following manner. The area under Federal jurisdiction was obtained from supervising agencies. Various Florida State agencies provided the figures for forests, parks, and other State-owned lands. County and municipal ownerships were obtained at county courthouses and city halls. In general the boundaries of these tracts were outlined on the aerial photographs or Soil Conservation Service maps, and dot counts were made to determine the acreage of forest and nonforest land. Forest plots were classified by forest type and stand class in each publicly owned area, thus giving the area by these classifications. Average volumes per acre by type and stand-size class, derived from survey unit summaries, were then applied to obtain volumes.

Definitions of Terms Used

Land-Use Classes

Forest land area—Includes (a) lands which are at least 5 percent stocked with trees of any size and capable of producing saw timber or other wood products, and (b) lands from which the trees described in (a) have been removed to less than 5-percent stocking but which have not been developed for other use, subdivided into the following classes:

1. *Commercial*—Forest land which is (a) producing, or physically capable of producing, usable crops of wood (usually saw timber), (b) economically available now or in the future, and (c) not withdrawn from timber utilization.
2. *Noncommercial*—Forest land (a) withdrawn from timber utilization through statute, ordinance, or administrative order, but which otherwise qualifies as commercial forest land and (b) incapable of yielding wood products (usually saw timber) because of adverse site conditions, or so physically inaccessible as to be unavailable economically in the foreseeable future.

Nonforest land—Land that does not qualify as forest land, subdivided as follows:

1. *Active agriculture*—Land under cultivation or in pasture, including farmyards and work lots.
2. *Idle agriculture*—Land previously cultivated or pastured but now idle or abandoned and having less than a 5-percent stocking of trees.
3. *Marsh*—Low, wet areas characterized by a heavy growth of grass and reeds and an absence of timber.
4. *Sand dunes and beaches*—Nonforested sand dunes and coastal beaches.
5. *Urban and other areas*—Includes towns, residential and industrial suburban areas, schoolyards, cemeteries, roads, railroads, power lines, and other rights-of-way.
6. *Water*—Includes lakes, bays, and estuaries over 40 acres in size and streams, canals, and sloughs at least one-eighth of a mile in width which are classed as "inland water" by the Bureau of the Census. Smaller lakes and ponds between 1 acre and 40 acres in size,

and waterways between 120 feet and 660 feet in width, which are classed as land area by the Bureau of the Census, are also included as water areas.

Forest Types[9]

Pine types—Stands in which softwood species comprise at least 25 percent of the dominant and codominant trees with the named pine species predominating. Scattered stands of shortleaf pine and spruce pine are included with the loblolly pine type.

Cypress—Stands in which softwood species comprise at least 25 percent of the dominant and codominant trees with cypress or white cedar predominating.

Lowland hardwoods—Stands in which mixed hardwoods such as water tupelo, blackgum, sweetgum, white oak, water oak, red maple, and ash comprise at least 75 percent of the dominant and codominant trees. Found along rivers, small streams, and in swamps and bays.

Upland hardwoods—Stands in which mixed hardwoods such as red oak, white oak, post oak, hickory, ash, sweetgum, elm, and yellow-poplar comprise at least 75 percent of the dominant and codominant trees. Found on the drier upland sites and on low rolling hills bordering the flatwood zone.

Scrub oak—Stands in which scrub species such as blackjack, bluejack, turkey and laurel oaks predominate and in which sound commercial species comprise less than 5 percent of satisfactory stocking.

Palms—Stands in which there is at least a 5-percent stocking of merchantable palm trees and less than 5-percent stocking of other sound commercial species.

Stand-size Classes

Saw timber—Stands with saw-timber trees having a minimum net volume of 1,500 board feet net, International ¼-inch log rule, per acre in sound, live, softwood trees 9.0 inches d.b.h. or larger, or hardwood trees 11.0 inches d.b.h. or larger. Two classes of young saw-timber stands are recognized:

1. *Large saw timber*—Saw-timber stands having more than 50 percent of the net board-foot volume in softwood trees 15.0 inches d.b.h. or larger, or hardwood trees 17.0 inches d.b.h. or larger.
2. *Small saw timber*—Saw-timber stands having 50 percent or more of the net board-foot volume in softwood trees less than 15.0 inches d.b.h., or hardwood trees less than 17.0 inches d.b.h.

Pole timber—Stands failing to meet the saw-timber stand specification, but at least 10 percent stocked with pole-timber and larger trees (5 inches d.b.h. and larger) and with at least half the stocking in pole-timber trees.

Seedling and sapling—Stands not qualifying as either saw-timber or pole-timber stands, but having at least 10 percent stocking of trees of commercial species and with at least half the minimum stocking in seedlings and saplings. Eight hundred seedlings or saplings per acre are considered full stocking.

Nonstocked and other areas not elsewhere classified—Areas not qualifying as saw-timber, pole-timber, or seedling and sapling stands.

Diameters

D. b. h. (diameter at breast height)—Stem diameter in inches, outside bark, measured at 4½ feet above the ground.

Diameter class—All trees were tallied by 2-inch diameter classes, each class including diameters 1.0 inch below and 0.9 inch above the stated midpoint, e.g., trees 7.0 to and including 8.9 inches are in the 8-inch class.

Tree Classification

Growing stock—Net volume in cubic feet of live saw-timber trees and live pole-timber trees from stump to a minimum 4.0-inch top (of central stem) inside bark.

Saw-timber trees—Net volume in board feet, International ¼-inch rule, of softwood trees at least 9.0 inches d.b.h. and hardwood trees at least 11.0 inches d.b.h., with not less than one merchantable log 12 feet long, or with not less than 50 percent of the gross volume of the tree in sound timber.

Pole-timber trees—Straight-boled trees between 5.0 inches d.b.h. and saw-timber sizes.

Sound cull trees—Live trees of saw-timber or pole-timber size which meet required specifications of freedom from rot but will not make at least one merchantable sawlog, now or prospectively, according to regional specifications because of roughness, poor form, or species. Volumes shown in the text for sound

[9]Refers to types discussed in text but not to types listed in table 18.

cull trees also include the limbs, in sections 4 feet long and at least 4.0 inches in diameter inside bark, of sound saw-timber-size hardwoods. Scrub oak and noncommercial species such as ironwood, blue beech, sassafras, etc., are included in this group.

Rotten cull trees—Live trees of pole-timber and saw-timber sizes that fail to meet regional specifications of the proportion of sound volume to total volume.

Palms—All species of Sabal 5.0 inches d.b.h. and larger with at least 12 feet of clear stem. All palm trees were considered to be free of rotten defect.

Species Groups

Softwoods—All of the pines, eastern redcedar, Atlantic white-cedar, pond cypress, and baldcypress.

Soft-textured hardwoods—Black and water tupelos, sweetgum, soft maple, magnolia, and sweetbay. The other soft-textured hardwoods include cottonwood, willow, basswood, and yellow-poplar.

Hard-textured hardwoods—All of the oaks, hickories, ash, river birch, elm, hackberry, and sycamore.

Volume Estimates

Board-foot volume—The volume in board feet, measured by the International ¼-inch rule, exclusive of defect, of that portion of saw-timber trees of softwoods 9.0 inches d.b.h. and larger and hardwood trees 11.0 inches d.b.h. and larger, between the stump and the upper limit of merchantability for sawlogs.

Volume in cords—The volume in standard cords (including bark) of the sound portion of trees 5.0 inches d.b.h. and larger, between stump and a minimum top-stem diameter of 4.0 inches inside bark, and the volume in hardwood limbs, in sections 4 feet long and at least 4.0 inches in diameter inside bark.

Volume in cubic feet—Same as volume shown in cords except bark is not included.

International ¼-inch log rule—A rule for estimating the board-foot volume of 4-foot log sections, according to the formula $V = 0.905\ (0.22D^2 - 0.71D)$. The taper allowance for computing the volume in log lengths greater than 4 feet is 0.5 inch per 4-foot section. Allowance for saw kerf is ¼ inch.

Standard cord—A stacked pile, 4 x 4 x 8 feet, of unpeeled round or split bolts, estimated to contain, on the average in Florida, 72 cubic feet of softwoods (wood only) or 71 cubic feet of hardwoods (wood only).

Gum Naval Stores Conditions

Round timber—A minimum of 15 longleaf and slash pine trees 9.0 inches d.b.h. or larger per acre that have never been worked for naval stores.

Working—Longleaf and slash pine trees that are now being worked for naval stores.

1. *Front-faced*—Turpentine tree species on which the front or first face is now being worked.
2. *Back-faced*—Turpentine tree species on which the front face has been worked out and on which a back (second or third, etc.) face is being worked.

Resting—Longleaf and slash pine trees with a worked-out front face at least 5 feet high and on which back-facing has not been started.

Abandoned—Longleaf and slash pine trees on which faces less than 5 feet high were discontinued.

Worked-out—Longleaf and slash pine trees on which two or more faces at least 5 feet high have been worked out and with no possibility of supporting another face.

Stocking

Stocking is the extent to which growing space is effectively utilized by present or potential growing-stock trees of commercial species. The number of stems present by d.b.h. classes was used as a basis for stocking classification. Areas having the minimum numbers of trees listed below, either in a single diameter class or in combinations, were considered fully stocked.

D.b.h. (inches):	*Minimum number trees per acre*
2	800
4	600
6	450
8	300
10	200
12	150
14	110

Growth and Drain

Net annual growth of saw timber—The change in net board-foot volume during the calendar year in the live saw timber on commercial forest land resulting from natural causes exclusive of catastrophic

losses. Includes the gains accruing from the growth of small trees into saw-timber sizes during the year.

Net annual growth of growing stock—The change in cubic-foot volume during the calendar year in the stem volume of all live trees 5.0 inches and larger resulting from natural causes, excluding catastrophic losses. Includes the gains accruing from the growth of saplings into pole sizes during the year.

Annual mortality of saw timber—The net volume removed from live saw timber during the calendar year through death from natural causes. Catastrophic losses are not included.

Annual mortality of growing stock—The net volume removed from the growing stock during the calendar year through death from natural causes. Catastrophic losses are not included.

Commodity drain on saw timber—The net board-foot volume of live saw-timber trees removed from commercial forest land during the calendar year as timber products and logging waste.

Commodity drain on growing stock—The net cubic-foot volume of growing-stock trees removed from commercial forest land during the calendar year as timber products and logging waste.

Common and Botanical Names of Principal Tree Species

SOFTWOODS

Lumber or trade name	*Recognized common name*	*Botanical name*
Cedar, red	Eastern redcedar	*Juniperus virginiana.*
Cedar, red	Southern redcedar	*J. silicicola.*
Cedar, white	Atlantic white-cedar	*Chamaecyparis thyoides.*
Cypress	Baldcypress	*Taxodium distichum.*
	Pondcypress	*T. ascendens.*
Palm	Palmetto	*Sabal* sps.
Pine, southern yellow	Loblolly pine	*Pinus taeda.*
	Longleaf pine	*P. palustris.*
	Pond pine	*P. rigida* var. *serotina.*
	Sand pine	*P. clausa.*
	Shortleaf pine	*P. echinata.*
	Slash pine	*P. elliottii* (*syn.* "*P. caribaea*" U. S. authors)
	Spruce pine	*P. glabra.*

HARDWOODS

Lumber or trade name	*Recognized common name*	*Botanical name*
Ash	Ash	*Fraxinus* sps.
Basswood	Basswood	*Tilia* sps.
Beech	American beech	*Fagus grandifolia.*
Birch	River birch	*Betula nigra.*
	Sweet birch	*B. lenta.*
Buckeye	Buckeye	*Aesculus* sps.
Butternut	Butternut	*Juglans cinerea.*
Cherry	Black cherry	*Prunus serotina.*
Cottonwood	Cottonwood	*Populus* sps.
Dogwood	Flowering dogwood	*Cornus florida.*
Elm, soft	Elm	*Ulmus* sps.
Gum, black	Black tupelo (blackgum)	*Nyssa sylvatica.*
Gum, red	Sweetgum	*Liquidambar styraciflua.*
Hackberry	Hackberry	*Celtis occidentalis.*
Hickory	Hickory	*Carya* sps.
Holly	American holly	*Ilex opaca.*
Honeylocust	Honeylocust	*Gleditsia triacanthos.*
Hornbeam	American hornbeam	*Carpinus caroliniana.*
Ironwood	Eastern hophornbeam	*Ostrya virginiana.*
Locust	Black locust	*Robinia pseudoacacia.*
Magnolia	Southern magnolia	*Magnolia grandiflora.*
	Sweetbay	*M. virginiana.*
Maple, soft	Boxelder	*Acer negundo.*
	Red maple	*A. rubrum.*
	Silver maple	*A. saccharinum.*
Mulberry	Red mulberry	*Morus rubra.*

Lumber or trade name	*Recognized common name*	*Botanical name*
Oak, red	Black oak	*Quercus velutina.*
	Blackjack oak	*Q. marilandica.*
	Bluejack oak	*Q. cinerea.*
	Cherrybark oak	*Q. falcata* var. *leucophylla.*
	Laurel oak	*Q. laurifolia.*
	Pin oak	*Q. palustris.*
	Scarlet oak	*Q. coccinea.*
	Shumard oak	*Q. shumardii*
	Southern red oak	*Q. falcata.*
	Swamp red oak	*Q. falcata* var. *pagodaefolia.*
	Turkey oak	*Q. catesbaei.*
	Water oak	*Q. nigra.*
	Willow oak	*Q. phellos.*
Oak, white	Chestnut oak	*Q. montana.*
	Live oak	*Q. virginiana.*
	Overcup oak	*Q. lyrata.*
	Post oak	*Q. stellata.*
	Swamp chestnut oak	*Q. prinus.*
	White oak	*Q. alba.*
Persimmon	Common persimmon	*Diospyros virginiana.*
Redbud	Eastern redbud	*Cercis canadensis.*
Sassafras	Sassafras	*Sassafras albidum.*
Sourwood	Sourwood	*Oxydendrum arboreum.*
Sycamore	American sycamore	*Platanus occidentalis.*
Tupelo	Water tupelo	*Nyssa aquatica.*
Walnut	Black walnut	*Juglans nigra.*
Willow	Willow	*Salix* sps.
Yellow-poplar	Yellow-poplar	*Liriodendron tulipifera.*

Forest Survey Standard Tables

As each State throughout the Nation is reported upon by the Forest Survey following initial or resurveys, a standard set of tables presenting information on forest area, ownership, timber volume, growth and drain will be presented. With such tables, forest statistics for any region or group of States can easily be compiled. Standard tables prepared for the State of Florida, based on the 1949 survey, appear on the following pages.

TABLE 10.—*Land area by major classes of land, Florida, 1949*

Class of land	Land area
	Thousand acres
Forest:	
Commercial	21,451
Noncommercial:	
Reserved from commercial timber use	46
Unproductive for timber use	1,550
Total	23,047
Nonforest [1]	11,681
Total, all classes	34,728

[1] Includes 249 thousand acres of water according to Survey standards of area classification, but defined by the Bureau of Census as land.

TABLE 11.—*Commercial forest land area by ownership and stand-size class, Florida, 1949*

Ownership class	Total	Saw-timber stands	Pole-timber stands	Seedling and sapling stands	Nonstocked and other areas[1]
Federally owned or managed:	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
National forest	1,025	212	327	213	273
Indian	36	(2)	(2)	1	35
Other	920	141	110	56	613
Total	1,981	353	437	270	921
State	223	35	16	7	165
County and municipal	56	6	4	2	44
Private	19,191	2,839	3,073	2,017	11,262
Total, all ownerships	21,451	3,233	3,530	2,296	12,392

[1] Includes areas not elsewhere classified.
[2] Less than 500 acres.

TABLE 12.—*Area of commercial forest land, by major forest types, Florida, 1949*

Forest type[1]	Thousand acres
Longleaf-slash pine	12,993
Loblolly-shortleaf pine	1,144
Oak-hickory	[2] 2,481
Oak-pine	654
Oak-gum-cypress	4,179
Total	21,451

[1] Forest-type acreages in this table were computed on a cubic-volume basis except for seedling and sapling stands, where number of stems was the criterion. Specifications required 50 percent of the cubic volume of number of stems of the indicated species except for the hardwood-pine type which required 25 percent pine.

[2] Includes upland hardwoods and scrub oak types shown elsewhere in this report.

TABLE 13.—*Net volume of live saw timber and growing stock on commercial forest land, by stand-size class, Florida, 1949*

Stand-size class	Saw timber	Growing stock
	Million bd. ft.	*Million cu. ft.*
Saw-timber stands	13,517	3,933
Pole-timber stands	2,975	1,914
Seedling and sapling stands	1,055	442
Nonstocked and other areas not elsewhere classified	3,047	1,068
Total	20,594	7,357

TABLE 14.—*Net volume of live saw timber and growing stock on commercial forest land, by ownership class, Florida, 1949*

Ownership class	Saw timber	Growing stock
	Million bd. ft.	*Million cu. ft.*
Federally owned or managed:		
National forest	1,331	520
Indian	12	6
Other	948	346
Total	2,291	872
State	201	71
County and municipal	39	15
Private	18,063	6,399
Total, all ownerships	20,594	7,357

TABLE 15.—*Net volume of live saw timber and growing stock on commercial forest land, by species, Florida, 1949*

Species	Saw timber	Growing stock
	Million bd. ft.	*Million cu. ft.*
Softwoods:		
Longleaf and slash pines	10,768	3,631
Shortleaf and loblolly pines	1,302	324
Other southern yellow pines	621	196
Cypress	3,095	1,199
Other eastern softwoods	91	24
Total	15,877	5,374
Hardwoods:		
White oaks	319	98
Red oaks	768	295
Soft maples	190	121
Sweetgum	629	237
Tupelo and blackgum	1,578	654
Ash	208	117
Hickory	157	57
Basswood	25	10
Yellow-poplar	40	19
Other eastern hardwoods	803	375
Total	4,717	1,983
Total, all species	20,594	7,357

TABLE 16.—*Net volume of live saw timber on commercial forest land by diameter-class group and selected species, Florida, 1949*

Species	Diameter-class group		
	9.0 to 12.9 inches d.b.h.[1]	13.0 to 18.9 inches d.b.h.	19.0 inches and larger d.b.h.
	Million bd. ft.	*Million bd. ft.*	*Million bd. ft.*
Longleaf and slash pines	7,592	2,905	271
Shortleaf and loblolly pines	449	696	157
White and chestnut oaks	44	105	170
Tupelo and blackgum	424	834	320
Sweetgum	143	370	116
Yellow-poplar	12	28	----------

[1] 10-inch diameter class not included for eastern hardwoods.

TABLE 17.—*Net volume of all timber on commercial forest land, by class of material and species group, Florida, 1949*

Class of material	Total	Softwoods	Hardwoods
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*
Growing stock:			
Saw-timber trees:			
Sawlog portion	3,502	2,687	815
Upper stems	771	592	179
Total	4,273	3,279	994
Pole-timber trees	3,084	2,095	989
Total growing stock	7,357	5,374	1,983
Other material:			
Sound cull trees:			
Saw-timber size	1,086	96	990
Pole-timber size	1,431	86	1,345
Total	2,517	182	2,335
Rotten cull trees	1,167	168	999
Hardwood limbs	281	----------	281
Total, other material	[1] 3,965	350	3,615
Total, all classes	11,322	5,724	5,598

[1] Includes 1,009 million cu. ft. of palms.

TABLE 18.—*Net annual growth, annual mortality and commodity drain of live saw timber and growing stock on commercial forest land, Florida, 1949*

Item	Saw timber			Growing stock		
	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
	Million bd. ft.	*Million bd. ft.*	*Million bd. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Net annual growth	1,125	935	190	370	291	79
Annual mortality	105	78	27	36	27	9
Commodity drain	937	824	113	232	206	26

TABLE 19.—*Total output of timber products from all timber, Florida, 1948*

Timber product	Standard unit	Number	M cubic feet, excluding bark
Sawlogs (for lumber and sawn ties)	M bd. ft. [1]	546,900	88,820
Veneer bolts	---do	86,200	13,590
Cooperage bolts	---do	10,500	1,640
Pulpwood bolts	Standard cords[2]	1,221,200	96,960
Fuel wood	---do	351,700	28,400
Chemical wood	---do	608,700	39,560
Piling	Linear feet	1,048,500	740
Poles	Pieces	373,200	5,330
Post (round and split)	---do	1,710,400	1,120
Hewn ties	---do	1,402,100	8,340
Miscellaneous	M cu. ft.	1,520	1,520
Total, all timber	----------	----------	286,020

[1] Board feet, International ¼-inch rule.

[2] Standard cords—rough wood (unpeeled). A pile of stacked wood 4 feet by 4 feet by 8 feet within its outside surface.

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MAJOR FOREST TYPES – FLORIDA

1950

U. S. DEPARTMENT OF AGRICULTURE – FOREST SERVICE
SOUTHEASTERN FOREST EXPERIMENT STATION – I. T. HAIG, DIRECTOR

LEGEND

- LONGLEAF-SLASH PINE
- LOBLOLLY PINE
- SAND PINE
- OAK-PINE
- OAK-HICKORY
- OAK-GUM-CYPRESS
- UNPRODUCTIVE FOREST
- PALMS
- PRAIRIE OR MARSH

SCALE IN MILES
10 0 10 20 30 40

GULF OF MEXICO

ATLANTIC OCEAN

Pensacola
Milton
Crestview
Bonifay
Chipley
Marianna
De Funiak Springs
Blountstown
Bristol
Panama City
Apalachicola
Monticello
TALLAHASSEE
Madison
Jasper
Live Oak
Lake City
Perry
Mayo
Crawfordville
Starke
Jacksonville
Fernandina
St Augustine
Green Cove Springs
Palatka
Gainesville
Cross City
Trenton
Bronson
Ocala
Inverness
Tavares
Sanford
Bushnell
Brooksville
Orlando
Dade City
Kissimmee
Titusville
Vero Beach
Tampa
Clearwater
Bartow
Wauchula
Sebring
Bradenton
Sarasota
Arcadia
Okeechobee
Ft Pierce
Stuart
Punta Gorda
Moore Haven
La Belle
Fort Myers
West Palm Beach
Fort Lauderdale
Everglades
Miami
Homosassa River
Withlacoochee River
Suwannee River
St Johns River
St Marys River
Kissimmee River
Caloosahatchee River
Escambia River
Blackwater River
Yellow River
Choctawhatchee River
Apalachicola River
Ochlockonee River
Aucilla River
Econfina River
Fenholloway River
Wacissa River
Withlacoochee River
Peace River
Myakka River
Caloosahatchee River
Lake Okeechobee
Everglades